SECTION 3

Project Description

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

3 PROJECT DESCRIPTION

3.1 COAL RESOURCE, GEOLOGICAL FEATURES AND EXPLORATION ACTIVITIES

The Project would extract the Wongawilli Seam (also known as the No 3 Seam) and Bulli Seam in the Late Permian Illawarra Coal Measures.

The Mine currently extracts coal from the Wongawilli Seam. The Bulli Seam Operations (also owned and operated by South32) currently extracts coal from the Bulli Seam.

Further information on the characteristics of the coal resource, geological features and previous and proposed exploration activities are provided below.

Geology

The Project is located in the NSW Southern Coalfield within the southern portion of the Permo-Triassic Sydney Basin.

The Late Permian Illawarra Coal Measures contain a number of workable seams in the Southern Coalfield. Above the Illawarra Coal Measures, the stratigraphy consists of a sequence of sandstone, shale and claystone units within the Narrabeen Group which are, in turn, overlain by the Hawkesbury Sandstone.

A typical stratigraphic section of the Project area is shown on Figure 3-1.

Mineable areas of the Wongawilli Seam and the Bulli Seam have been identified in the Project underground mining areas. A summary of the characteristics of the target seams in the vicinity of the Project is provided in Table 3-1.

Table 3-1
Characteristics of the Target Coal Seams in the Project Area

Seam	Depth of Cover (m)	Seam Thickness (m)
Wongawilli Seam	375 – 460	9 – 11*
Bulli Seam	250 – 390	2 – 3

m – metres.

* The working section thickness is 2.5 – 4 m.

The coal seams have a regional dip to the north of about 1 in 50.

The Wongawilli Seam is the thickest and most widespread coal seam in the Southern Coalfield (Department of Mineral Resources [DMR], 2000). The Project would mine the lower portion of the Wongawilli Seam in Area 6, as the upper portion is characterised by carbonaceous claystones, tuffs and interbedded coal (DMR, 2000). The seam floor consists of sandstone.

The Wongawilli Seam has a high vitrinite content and can be blended with the Bulli Seam to produce a hard coking coal, or can produce thermal coal products.

The Bulli Seam is the uppermost seam of the Illawarra Coal Measures (DMR, 2000). The Project would generally mine the full height of the Bulli Seam in Area 5. The seam floor consists of mudstone and carbonaceous mudstone. Generally, the Bulli Seam produces a coking blend coal. There are portions of the Project area where igneous intrusions are in proximity to the Bulli Seam. These portions are termed “heat affected” and produce a thermal or PCI product.

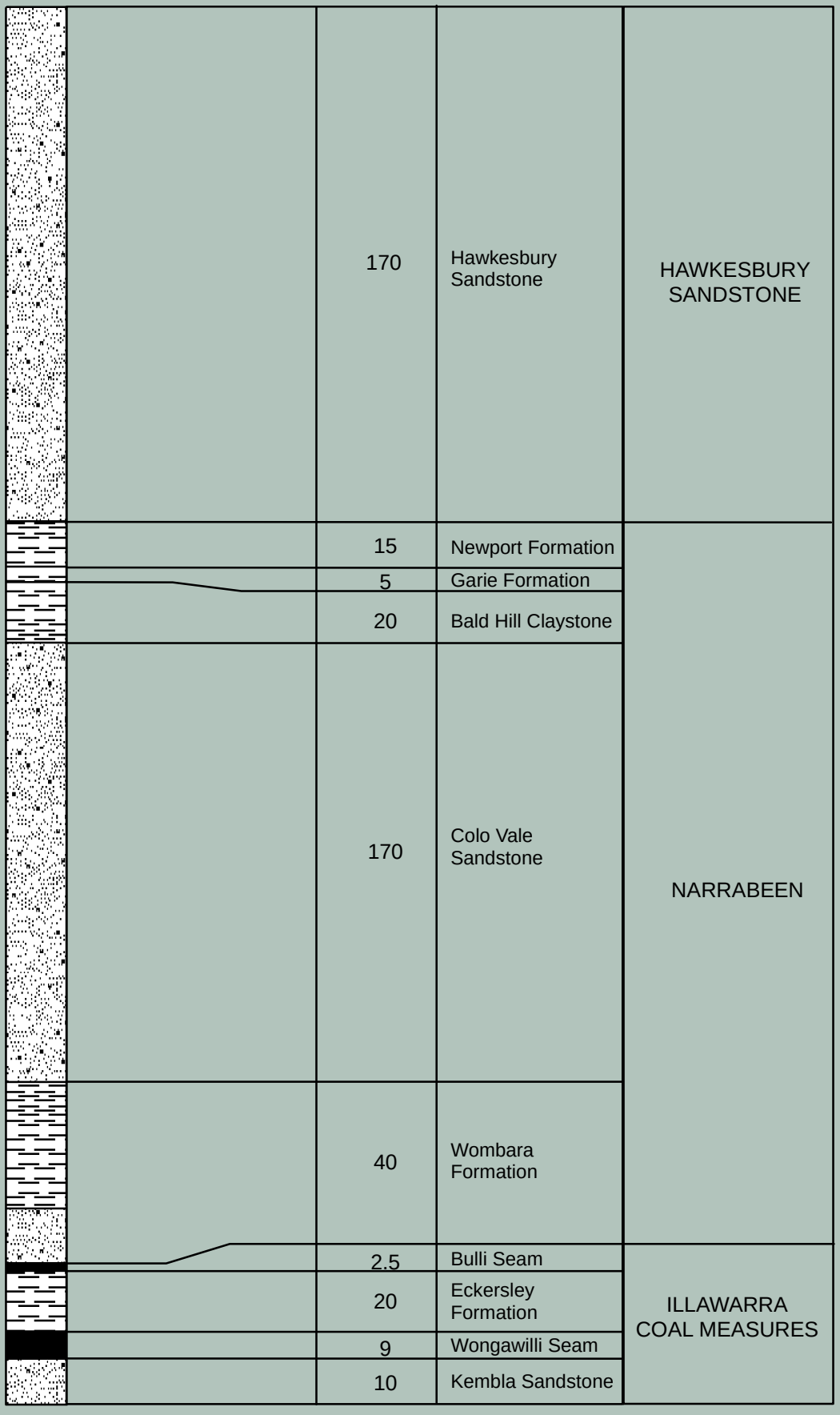
Known and inferred geological features in the vicinity of the Project underground mining areas are shown on Figure 3-2.

A large syncline runs through Area 6 and to the east of Area 5, plunging to the north. Several north-south trending lineaments are also present in the vicinity of the Project underground mining area, including the Narellan, Cordeaux River and Avon River Lineaments.

A displacement in the Bulli Seam in the northwest of Area 5 is inferred from seismic surveys. Further exploration will be conducted to determine the characteristics of any disturbance in this area. Igneous intrusions in the middle of Area 5 have been detected in the Bulli Seam by seismic assessment and exploration drilling. The eastern extent of Area 5 is defined by a large area of intrusion in the Bulli Seam. The intrusions are altered, moderately hard and vary in thickness from 1 to 3 m.

The eastern extent of Area 6 is defined by a number of faults detected by Cordeaux Mine in the 1990s. These faults have displacements of 10 to 30 m.

South32 continues to develop a geological model across the Project area that is progressively updated with the most recent and reliable data.

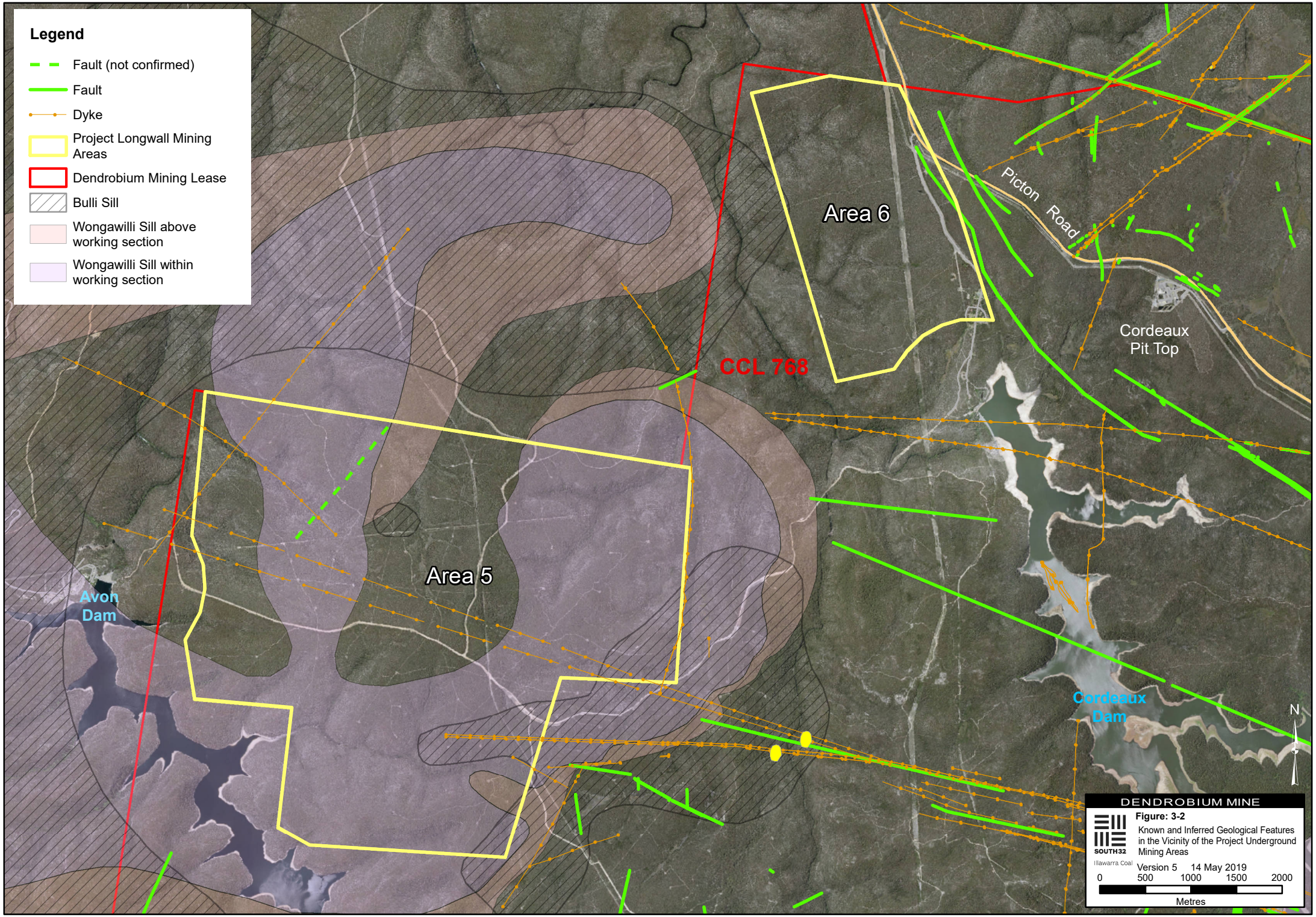


DENDROBIUM MINE

Figure: 3-1
Indicative Stratigraphic Section-Project Area

SOUTH32 Illawarra Coal

Version 5 22 March 2019


Legend
Fault (not confirmed)
Fault
Dyke
Project Longwall Mining Areas
Dendrobium Mining Lease
Bulli Sill
Wongawilli Sill above working section
Wongawilli Sill within working section
Area 6
Area 5
CCL 768
Picton Road
Cordeaux Pit Top
Avon Dam
Cordeaux Dam
N
DENDROBIUM MINE
Figure: 3-2
Known and Inferred Geological Features in the Vicinity of the Project Underground Mining Areas
SOUTH32
Illawarra Coal
Version 5 14 May 2019
0 500 1000 1500 2000
Metres

Exploration

The exploration program conducted to date to support the Project has focused on determining seam quality, gas levels, geotechnical constraints and the locations of major geological structures and igneous intrusions.

Mine exploration activities would continue during the life of the Project. These activities would investigate geological structures, seam gas content and composition, and seam morphology as input to detailed mine planning and engineering studies. This data, in combination with surface exploration and underground mapping data would be used to build robust geological models upon which detailed mine plans can be developed.

Surface exploration activities would generally require only small surface areas and would involve the use of surface drilling rigs and supporting equipment, low-impact seismic acquisition, surface mapping and airborne and ground-based geophysical surveys.

In addition to surface based exploration, in-seam drilling would be undertaken in advance of mining in order to identify minor geological structures and drain the gas from the coal seam (and adjacent strata). In-seam drilling has been undertaken since the 1970s to prevent outbursts (gas-driven ejection of coal from the active mining face), which have historically caused fatalities in the Southern Coalfield.

Exploration activities meeting the definition of "prospecting" under the *Mining Act, 1992* do not form part of the Project. Separate assessment of exploration activities would be undertaken pursuant to Part 5 of the EP&A Act.

Coal Resource

The Project seeks the extraction of approximately 78 Mt of ROM coal from Areas 5 and 6 over the life of the Project from CCL 768.

Table 3-2 shows a subset of South32 Illawarra Metallurgical Coal (Attachment 10) Financial Year 2018 Resources Statement within Project and approved mine plans. Resource recovery for the Project is constrained by geological, environmental and infrastructure features (Section 3.5.2).

There is a low level of geological confidence associated with *Inferred Resources* and there is no certainty that further exploration work will result in the determination of Indicated Mineral Resources or that the production target itself will be realised. Further evaluation work and appropriate studies are required to establish sufficient confidence that this target will be met. Note that the *Inferred Resources* component in Areas 5 and 6 are estimated to constitute 20% and 24%, respectively (Table 3-2).

Table 3-2
Coal Resources within Project and Approved Mine Plans (Financial Year 2018)[1]

Reporting Entity and Domain	Resource Classification	Financial Year 2018 as at 30/06/18 - Coal Resources			
		Mt	Ash (%)	Volatile Matter (%)	Sulfur (%)
Bulli Area 5	Measured	-	-	-	-
	Indicated	44	12.2	22.8	0.36
	Inferred	11	12.7	23.1	0.37
	Bulli Total	**54**	**12.3**	**22.9**	**0.36**
Wongawilli Area 6	Measured	-	-	-	-
	Indicated	19	28.3	22.7	0.57
	Inferred	6.1	28.0	22.7	0.57
	Wongawilli Total	**25**	**28.2**	**22.7**	**0.57**
Wongawilli Area 3B	Measured	21	29.1	24.2	0.59
	Indicated	6.5	28.7	23.9	0.59
	Inferred	2	27.5	22.8	0.59
	Wongawilli Total	**29**	**28.9**	**24.0**	**0.59**
Wongawilli Area 3C	Measured	0.1	27.4	23.5	0.60
	Indicated	23	28.4	22.9	0.59
	Inferred	1	28.0	23.1	0.60
	Wongawilli Total	**24**	**28.4**	**22.9**	**0.59**

3.2 PROJECT GENERAL ARRANGEMENT

The Project proposes the extraction of additional coal within CCL 768. This would be supported by the development of supporting infrastructure and the use and augmentation of existing Dendrobium Mine surface facilities.

The Project would support the extraction of approximately 78 Mt of ROM coal from Area 5 and Area 6 (in addition to approximately 35 Mt of ROM coal from the approved Areas 3B and 3C). The life of the Project would be to 31 December 2048. The Project would include the following activities:

- longwall mining of the Bulli Seam in a new underground mining area (Area 5);
- longwall mining of the Wongawilli Seam in a new underground mining area (Area 6);
- development of underground roadways within the Bulli Seam, Wongawilli Seam and adjacent strata to access mining areas;
- use of existing underground roadways and drifts for personnel and materials access, ventilation, dewatering and other ancillary activities related to Areas 5 and 6;
- development of surface infrastructure associated with mine ventilation and gas management and abatement, water management and other ancillary infrastructure;
- handling and processing of up to 5.2 Mtpa of ROM coal;
- use of the existing Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Dendrobium CPP and Dendrobium Shafts with minor upgrades and extensions;
- transport of sized ROM coal from the Kemira Valley Coal Loading Facility to the Dendrobium CPP via the Kemira Valley Rail Line;
- use of the Cordeaux Pit Top for mining support activities to reduce travel time for men and materials while development and mining operations occur in Area 6;
- augmentation of mine access arrangements, including upgrades to, and the use of, the Cordeaux Pit Top;
- handling and processing of coal from the Project, the approved Dendrobium Mine and the Bulli Seam Operations at the Dendrobium CPP;
- delivery of product coal from the Dendrobium CPP to the Port Kembla Steelworks for domestic use or to the Port Kembla Coal Terminal for transport to Liberty Primary Steel Whyalla Steelworks or export;
- transport of coal wash by road to customers for engineering purposes (e.g. civil construction fill), for other beneficial uses and/or for emplacement at the West Cliff Stage 3 and Stage 4 Coal Wash Emplacement;
- development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement (noting that opportunities for beneficial reuse of coal wash would be maximised);
- progressive development of sumps, pumps, pipelines, water storages and other water management infrastructure;
- controlled release of excess water in accordance with the conditions of EPL 3241 and/or beneficial industrial re-use;
- monitoring, rehabilitation and remediation of subsidence and other mining effects; and
- other associated infrastructure, plant, equipment and activities.

An indicative Dendrobium Mine general arrangement showing the proposed Project underground mining areas is provided on Figure 3-3.

Table 3-3 provides a summary of the key characteristics of the Project.

3.3 PROJECT SCHEDULE

An indicative Project schedule is provided in Figure 3-4.

3.4 PROJECT CONSTRUCTION AND OTHER DEVELOPMENT ACTIVITIES

The Project would use existing pit tops and supporting infrastructure. Additional infrastructure and upgrades to existing infrastructure that are required to support the Project would be progressively developed in parallel with ongoing mining operations, including:

- development of underground roadways, coal clearance infrastructure and other ancillary infrastructure required to access and support Project underground mining areas;

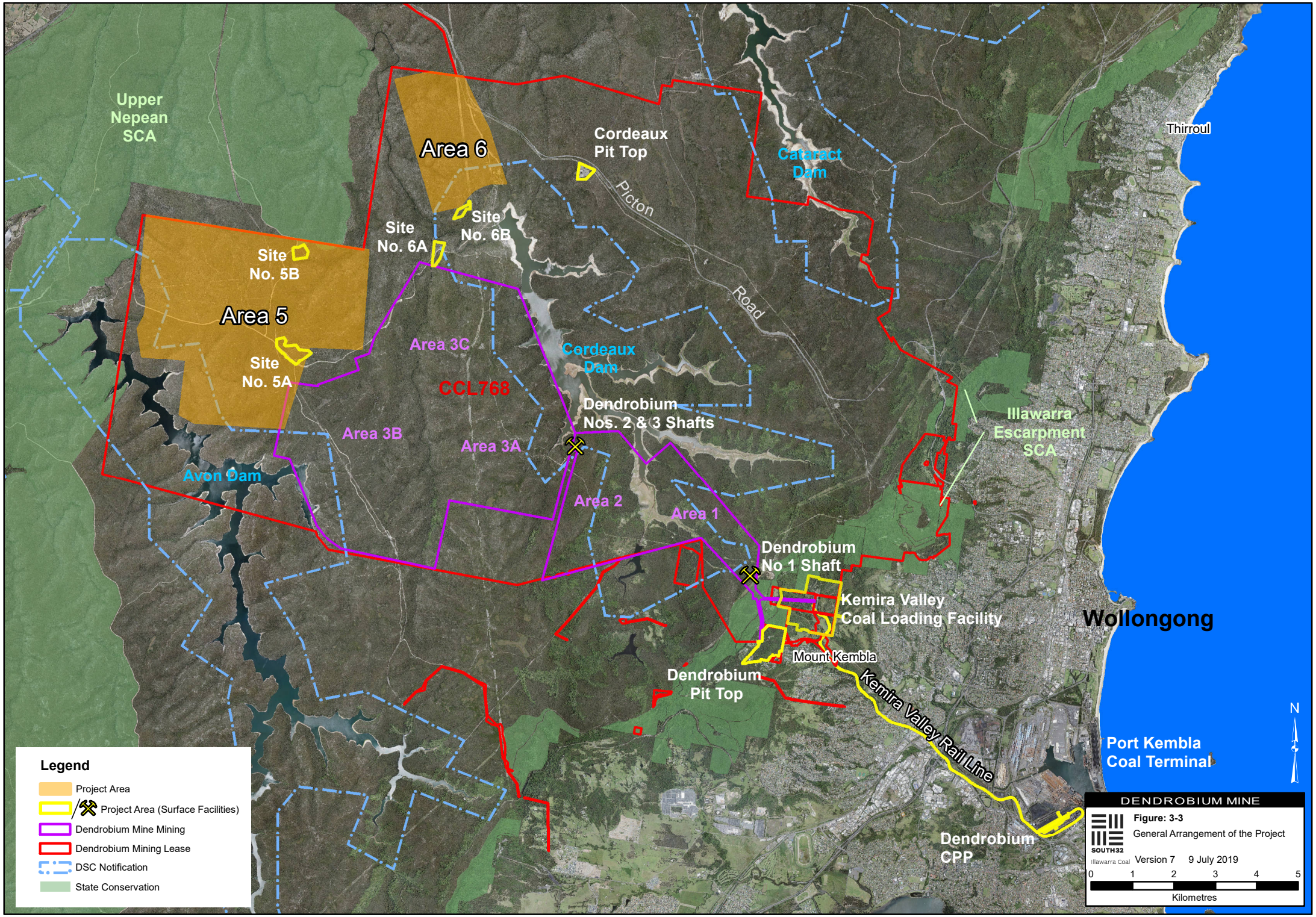
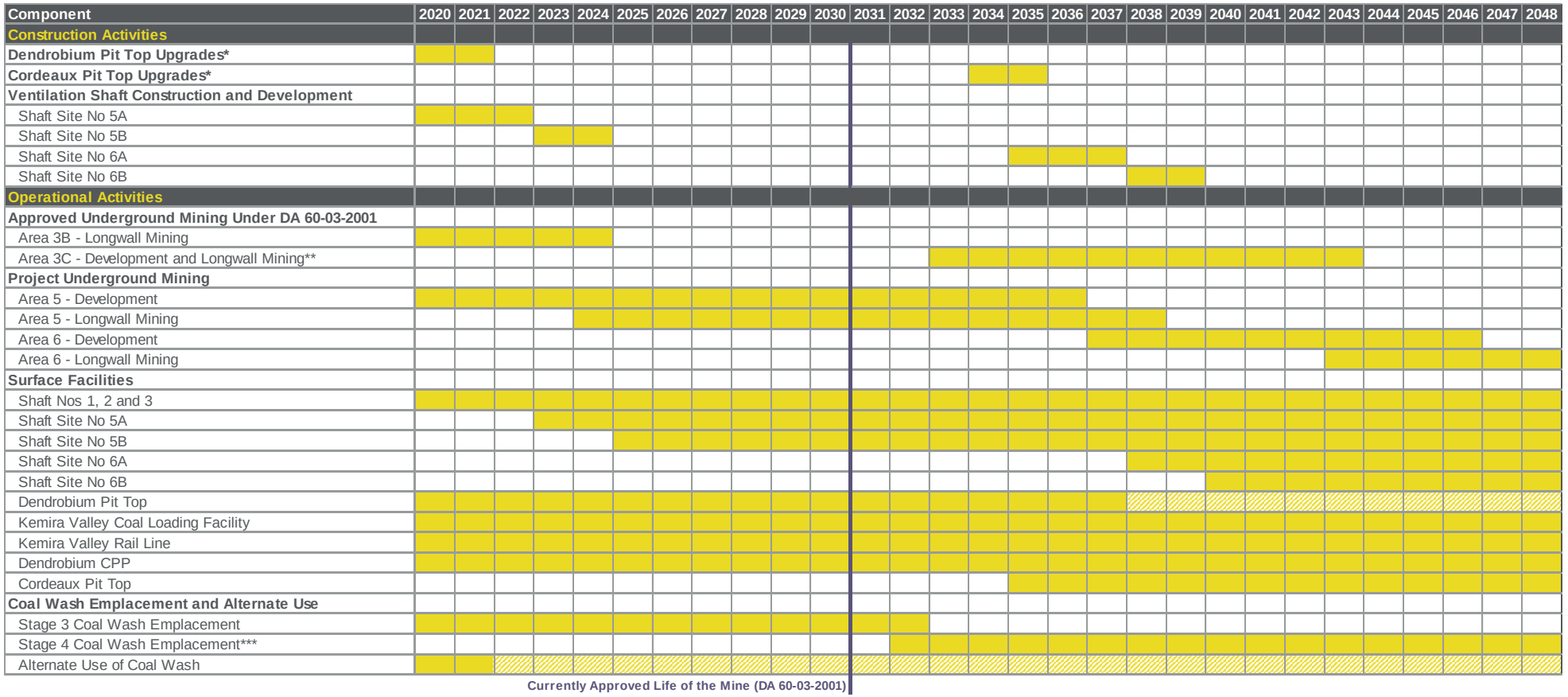

Upper Nepean SCA
Area 6
Cordeaux Pit Top
Cataract Dam
Thirroul
Picton Road
Site No. 6A
Site No. 6B
Site No. 5B
Area 5
Site No. 5A
Area 3C
Cordeaux Dam
CCL768
Dendrobium Nos. 2 & 3 Shafts
Illawarra Escarpment SCA
Area 3B
Area 3A
Avon Dam
Area 2
Area 1
Dendrobium No 1 Shaft
Kemira Valley Coal Loading Facility
Wollongong
Mount Kembla
Dendrobium Pit Top
Kemira Valley Rail Line
Port Kembla Coal Terminal
Dendrobium CPP
N
Legend
Project Area
Project Area (Surface Facilities)
Dendrobium Mine Mining
Dendrobium Mining Lease
DSC Notification
State Conservation
DENDROBIUM MINE
Figure: 3-3
General Arrangement of the Project
SOUTH32
Illawarra Coal
Version 7
9 July 2019
0 1 2 3 4 5
Kilometres

Table 3-3
Summary of Key Project Characteristics

Component	Project
Mining Method	Underground extraction using longwall mining methods.
Resource	Mining of the Bulli Seam in Area 5 and the Wongawilli Seam in Area 6 within CCL 768.
Annual Production	Production of up to 5.2 Mtpa of ROM coal.
Mine Life	Until 31 December 2048.
Total Resource Recovered	Approximately 78 Mt of ROM coal from Areas 5 and 6.
Coal Handling and Processing	Transport of coal from underground workings to the Kemira Valley Coal Loading Facility via an underground conveyor network. Continued sizing and stockpiling of coal at the Kemira Valley Coal Loading Facility prior to transport to the Dendrobium CPP via the Kemira Valley Rail Line, in accordance with the approved hours of operation. Continued processing of up to 5.2 Mtpa of sized ROM coal at the Dendrobium CPP.
Management of Mining Waste	Transportation of up to approximately 1.6 Mtpa of coal wash by road from the Dendrobium CPP to the West Cliff Stage 3 and Stage 4 Coal Wash Emplacement. A portion of this total would be made up of coal wash produced from the processing coal from remaining areas of the approved Dendrobium Mine (Area 3). Continued development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement.[1] Continued supply of coal wash to customers for engineering purposes (e.g. civil construction fill) or for other beneficial uses.
General Infrastructure	Continued use of the Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Kemira Valley Rail Line, Dendrobium CPP and Dendrobium Shafts Nos 1, 2 and 3 with upgrades and extensions. Use of the Cordeaux Pit Top for mining support activities. Augmentation of mine access arrangements, including upgrades to, and the use of, the Cordeaux Pit Top. Development of surface infrastructure associated with mine ventilation and gas management and abatement, and other ancillary infrastructure.
Product Transport	Continued delivery of product coal from the Dendrobium CPP to the BlueScope Steelworks or to the Port Kembla Coal Terminal for transport to Liberty Primary Steel Whyalla Steelworks or export.
Water Management	Augmentations and extensions to existing water management infrastructure. Continued use of a combination of recycled treated mine water and potable water purchased from Sydney Water in underground and surface operations. Continued release of water in accordance with the conditions of EPL 3241. Release volumes and release infrastructure to be modified as required based on Project mine inflow rates. Beneficial re-use of excess Project water by industrial users, where practicable.
Workforce	At full development, the Project would employ in the order of 500 operational personnel (including South32 staff and on-site contractor personnel). Up to approximately 200 contractor personnel may be required for surface facility construction and longwall development activities at any one time.
Hours of Operation	Operated on a continuous basis, 24 hours per day, seven days per week. Trains would not travel on the Kemira Valley Rail Line between 11.00 pm and 6.00 am, unless written approval is obtained from the EPA for emergency use of the rail line.
Capital Investment Value	$956 million.

[1] Development and rehabilitation of the West Cliff Stage 4 Coal Wash Emplacement would continue to be conducted in accordance with Project Approval 08_0150 for the Bulli Seam Operations.



*** The construction timeframes specified (i.e. 2-year periods) represent a likely construction window, with the majority of construction activities occuring intermittently within the 2-year period**

**** Subject to separate assessment and approval of an extension of Development Consent DA 60-03-2001 from 31 December 2030 to 31 December 2048**

***** Subject to separate assessment and approval of an extension of Project Approval 08_0150 from 31 December 2041 to 31 December 2048**

Figure 3-4 - Indicative Project Schedule

- underground mining machinery replacement and upgrades;
- development and augmentation of mine ventilation infrastructure;
- additional gas management and abatement infrastructure;
- upgrades to the Dendrobium Pit Top and decommissioning and removal of redundant infrastructure;
- upgrades to the Cordeaux Pit Top and decommissioning and removal of redundant infrastructure to facilitate men and materials access during development and mining operations in Area 6;
- ongoing maintenance and upgrades of the Kemira Valley Rail Line and water management infrastructure;
- upgrades and replacement of infrastructure at the Dendrobium CPP and removal of redundant infrastructure; and
- minor augmentations and upgrades of other surface facilities.

Construction would generally occur 7.00 am to 5.00 pm Monday to Sunday. Some construction and development works (e.g. drilling and construction of ventilation shafts, and underground development activities) would occur on a 24 hour per day basis.

Additional mobile equipment would be required for periods during the Project construction and development activities including drill rigs, mobile cranes, excavators, loaders and delivery trucks.

The number and type of equipment would vary depending on the construction development activity being undertaken.

3.4.1 Development of Access and Supporting Infrastructure for Underground Mining Areas

Underground roadways would be developed to access and support the Project underground mining areas (i.e. for access, ventilation and coal clearance).

Coal clearance infrastructure and other ancillary infrastructure would be developed for the Project underground mining areas.

The existing coal clearance infrastructure would also be upgraded and augmented progressively throughout the life of the Project through replacement or upgrades of conveyors, sizers, drives, winders and supporting systems.

Other ancillary infrastructure required to support the Project underground mining areas includes infrastructure for electricity distribution, communication systems, water management, services and service delivery (e.g. boreholes to the surface).

3.4.2 Underground Mining Machinery Replacement and Upgrades

Over the life of the Project it is anticipated that a range of underground mining equipment would be replaced or upgraded as a component of general maintenance, or to increase efficiency.

3.4.3 Mine Ventilation Infrastructure

The Project would involve the continued use of Dendrobium Shafts Nos 1, 2 and 3 (Figure 3-3).

The Project would involve the development of the following ventilation infrastructure (Figure 3-3):

- an additional ventilation shaft site to support Area 5 (Site No 5A) (maximum disturbance of approximately 7.5 ha);
- an optional additional ventilation shaft site to support Area 5 (Site No 5B) (maximum disturbance of approximately 3 ha); and
- two additional ventilation shaft sites to support Area 6 (Site No 6A and Site No 6B) (maximum disturbance of approximately 4 ha each).

Construction of ventilation shaft sites for the Project would involve:

- improvement of existing tracks and construction of new tracks to allow access (where necessary);
- development of concrete-lined or steel-lined shaft(s);
- installation of ventilation fan(s) and associated power supply if the site would be used as an upcast ventilation shaft;

- installation of a power supply and transmission and associated electrical switchroom, transformer and ancillary infrastructure for the ventilation fans;
- installation of appropriate security (i.e. fencing) to prevent unauthorised access to the ventilation shaft site;
- construction of sumps for the containment of drilling process water (pending its disposal underground or off-site);
- installation of erosion and sediment control infrastructure, where required;
- installation of an access/egress winder at the ventilation shaft sites to facilitate emergency transportation to/from underground mining operations; and
- other minor associated works.

It is expected that the shafts would be constructed from the surface down to the underground workings. Using this method, the shaft construction would take place in advance of development workings, with material from the excavation being removed from the top of the shaft. The construction footprint would be as shown on Figure 1-3.

The excavated material resulting from the construction of the shafts is proposed to be used as engineered fill and for construction of sediment dams. Any excess material is proposed to be stockpiled on-site, revegetated and used for future rehabilitation of the shaft site upon decommissioning.

Excavation of the shafts would occur 24 hours per day, seven days per week, while the remainder of construction activities associated with the ventilation shafts (e.g. installation of surface infrastructure) would generally be limited to daytime hours.

Ventilation fans, electrical infrastructure and other infrastructure at the existing Dendrobium Shafts may be upgraded or replaced during the life of the Project. The ventilation fans at Dendrobium Shaft No 3 may also be removed during the life of the Project and the site converted to a downcast ventilation shaft.

3.4.4 Gas Management and Abatement Infrastructure

Gas management and abatement infrastructure would be developed as described in Section 3.5.8.

Centralised gas management infrastructure would be constructed at the upcast ventilation shaft sites.

Gas management infrastructure would be fully fenced, and may include flares, pumps, nitrogen tanks, gas monitoring, water collection, surface pipes and other ancillary infrastructure.

Gas would be flared or, if the gas was too low in methane content for flaring (or other operational reasons), vented to the atmosphere.

3.4.5 Dendrobium Pit Top

Upgrades at the Dendrobium Pit Top (Figure 3-5) would include:

- construction of additional car parking facilities on the southern side of Cordeaux Road, including an additional intersection with Cordeaux Road;
- extension and relocation of bathhouses (e.g. change rooms), locker facilities and administration buildings; and
- additional electricity distribution infrastructure.

Other minor upgrades and augmentations would occur within the current disturbance footprint.

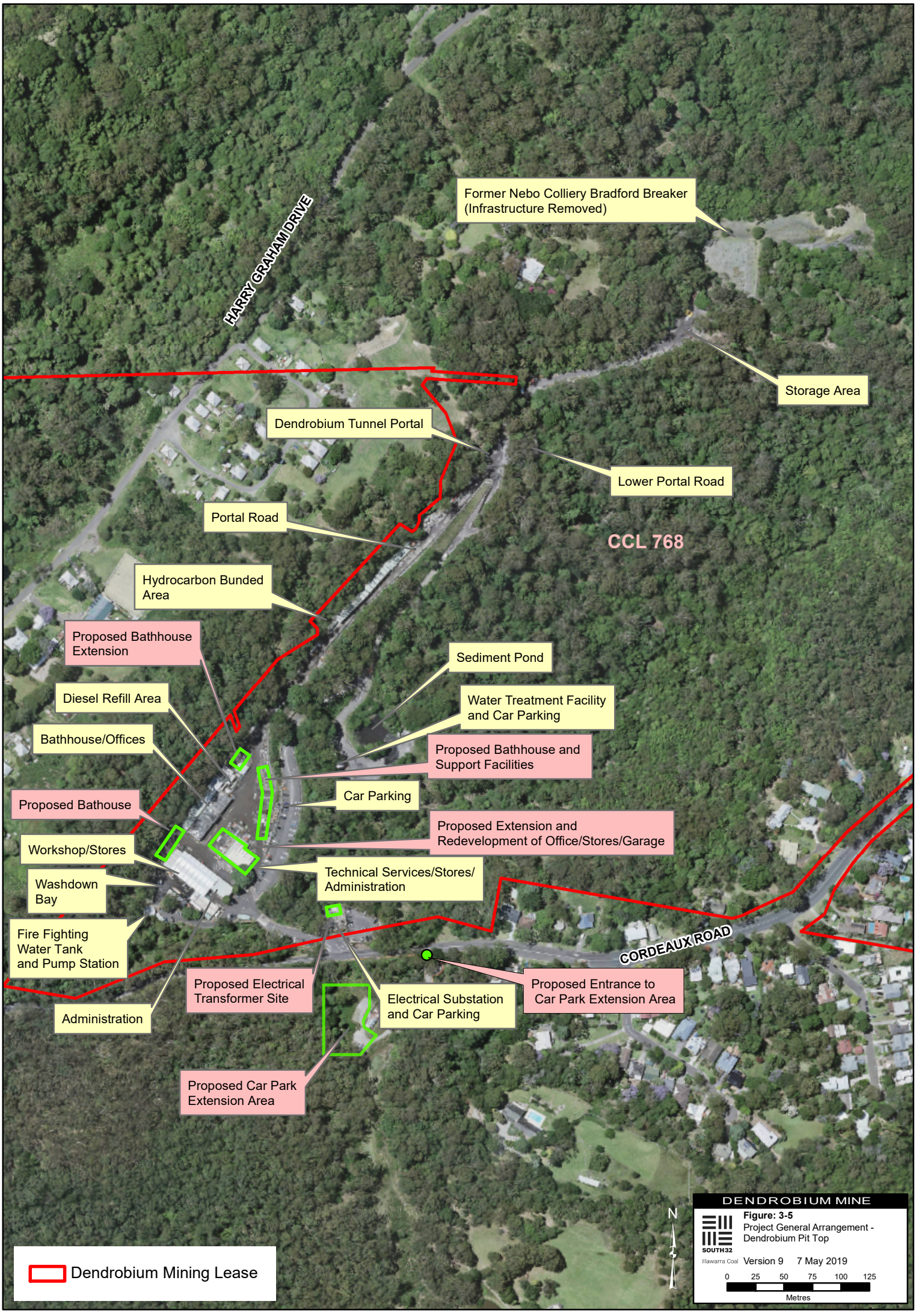
Existing infrastructure at the Dendrobium Pit Top that is no longer required may be decommissioned and removed (e.g. demountable buildings).

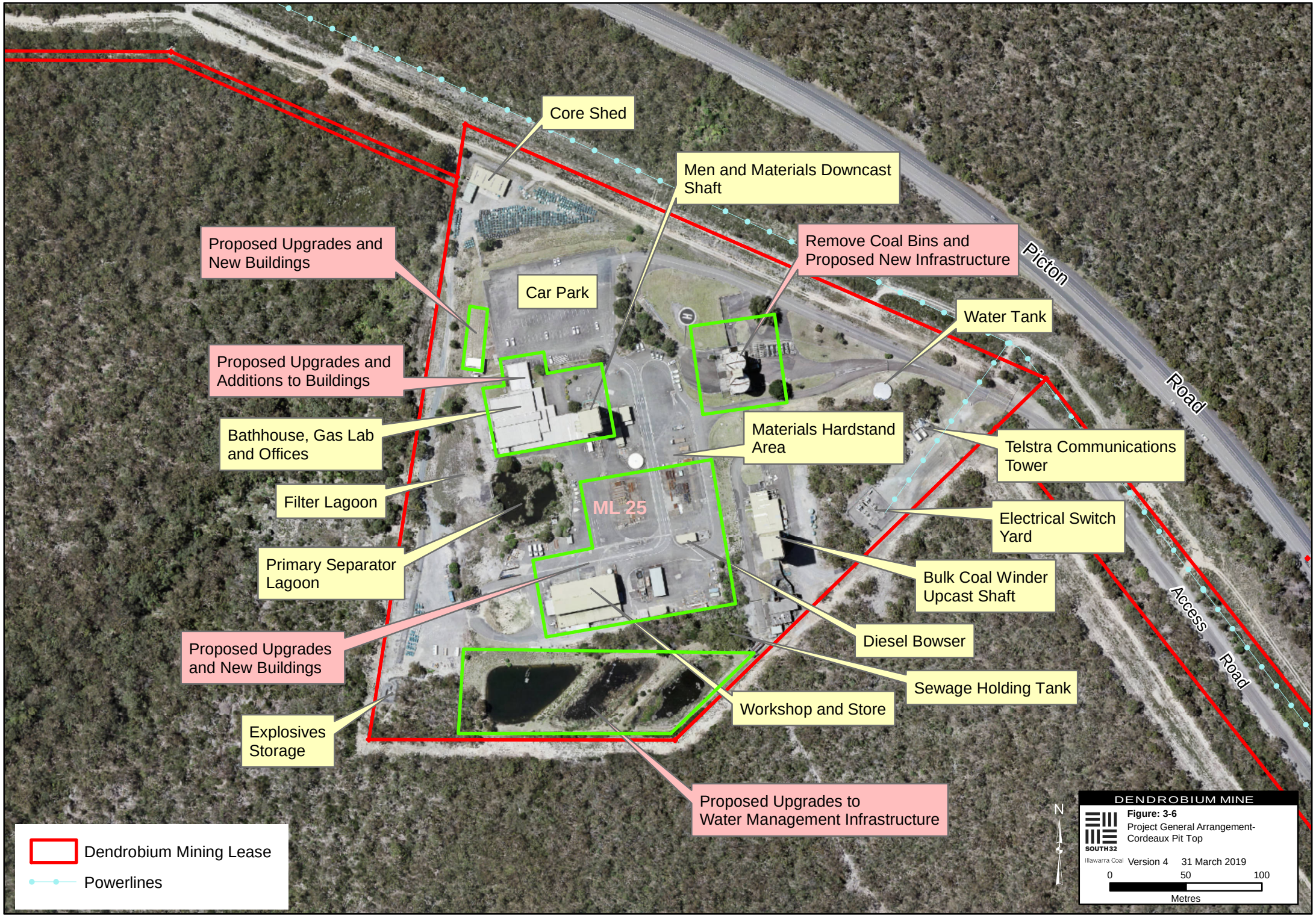
3.4.6 Cordeaux Pit Top

Upgrades to the Cordeaux Pit Top would occur to allow it to be used for personnel and materials access to the Project underground mining operations (for Area 6).

Upgrades at the Cordeaux Pit Top (Figure 3-6) would include, but not necessarily be limited to:

- upgrades to existing shafts, and development of new shafts and/or drifts to facilitate access to, ventilation of, and provision of services to the underground workings in Area 6;
- development of new buildings, and extension of existing buildings, within the existing surface lease to provide additional bathhouse facilities (e.g. change rooms), locker facilities, administration facilities and workshop areas;


Former Nebo Colliery Bradford Breaker (Infrastructure Removed)
HARRY GRAHAM DRIVE
Storage Area
Dendrobium Tunnel Portal
Lower Portal Road
Portal Road
CCL 768
Hydrocarbon Bunded Area
Proposed Bathhouse Extension
Sediment Pond
Diesel Refill Area
Water Treatment Facility and Car Parking
Bathhouse/Offices
Proposed Bathhouse and Support Facilities
Car Parking
Proposed Bathouse
Proposed Extension and Redevelopment of Office/Stores/Garage
Workshop/Stores
Technical Services/Stores/ Administration
Washdown Bay
Fire Fighting Water Tank and Pump Station
CORDEAUX ROAD
Proposed Electrical Transformer Site
Proposed Entrance to Car Park Extension Area
Electrical Substation and Car Parking
Administration
Proposed Car Park Extension Area
Dendrobium Mining Lease
N
DENDROBIUM MINE
Figure: 3-5
Project General Arrangement - Dendrobium Pit Top
SOUTH32
Illawarra Coal
Version 9 7 May 2019
0 25 50 75 100 125
Metres


Core Shed
Men and Materials Downcast Shaft
Proposed Upgrades and New Buildings
Remove Coal Bins and Proposed New Infrastructure
Car Park
Picton
Road
Water Tank
Proposed Upgrades and Additions to Buildings
Bathhouse, Gas Lab and Offices
Materials Hardstand Area
Telstra Communications Tower
Filter Lagoon
ML 25
Electrical Switch Yard
Primary Separator Lagoon
Bulk Coal Winder Upcast Shaft
Access Road
Proposed Upgrades and New Buildings
Diesel Bowser
Sewage Holding Tank
Workshop and Store
Explosives Storage
Proposed Upgrades to Water Management Infrastructure
Dendrobium Mining Lease
Powerlines
N
DENDROBIUM MINE
Figure: 3-6
Project General Arrangement-
Cordeaux Pit Top
SOUTH32
Illawarra Coal
Version 4
31 March 2019
0
50
100
Metres

- upgrades to existing water management infrastructure and development of new water management infrastructure; and
- upgrades to electricity distribution infrastructure.

Existing infrastructure at the Cordeaux Pit Top that is no longer required (e.g. the existing coal bins) may be decommissioned and removed.

Other minor upgrades and augmentations would occur within the existing surface lease area and current disturbance footprint (Figure 3-6).

Prior to use of the Cordeaux Pit Top as the primary operational access to the underground mine, South32 would undertake a review of traffic movements on Picton Road and projected Project traffic movements. Based on the outcomes of this review, South32 may:

- adjust shift start and finish times to minimise the overlap between peak Project traffic exiting the Cordeaux Pit Top and peak through-traffic on Picton Road; and/or
- undertake necessary upgrades to the access road intersection in consultation with RMS.

3.4.7 Kemira Valley Rail Line

A rail control room would be developed for the Kemira Valley Rail Line during the life of the Project (Figure 3-7).

Additional water management and ancillary infrastructure may also be installed within the Kemira Valley Rail Line easement.

Components of the Kemira Valley Rail Line would be replaced, upgraded or augmented during the life of the Project, including track work, culverts, crossings, signalling, fencing and screening.

3.4.8 Dendrobium CPP

A new conveyor from the Dendrobium CPP to the washed coal stockpile (Figure 3-8) would be developed during the life of the Project.

Existing components of the Dendrobium CPP would be replaced, upgraded or augmented during the life of the Project, including, but not necessarily limited to, conveyors, surge bins, storage bins, tanks, sumps, filters, centrifuges, thickeners, chutes, skirts, scrapers, sprays and electrical infrastructure.

Existing infrastructure at the Dendrobium CPP that is no longer required (e.g. coal bins that are no longer in use) may be decommissioned and removed.

3.4.9 Water Management System Upgrades

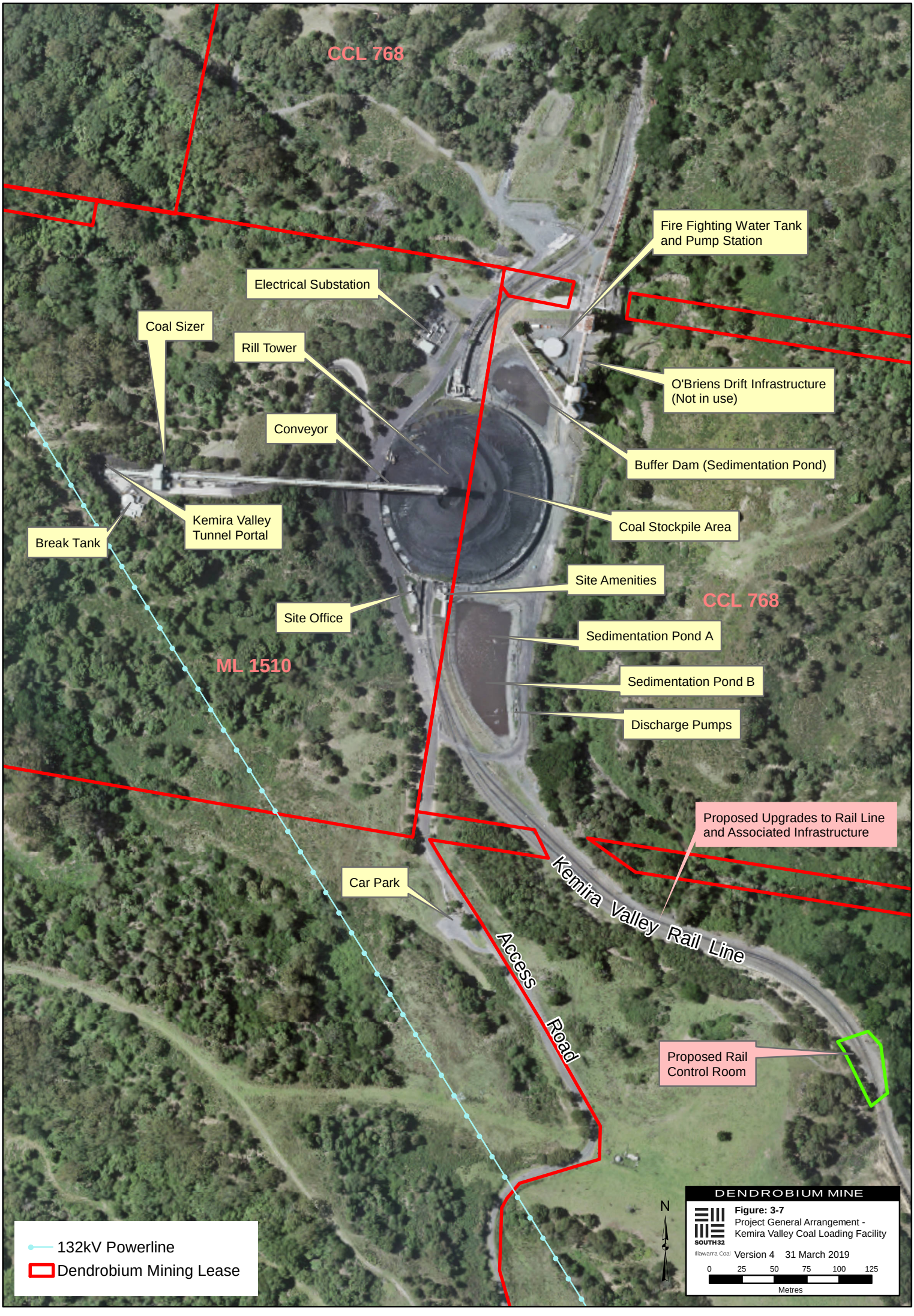
Project water management studies (Appendices B and C) indicate that the expansion of the Dendrobium Mine would be accompanied by increasing groundwater inflows, which would increase the volume of water to be transferred off-site for disposal or beneficial reuse. This may require augmentation or duplication of some water management infrastructure to accommodate increased mine inflows.

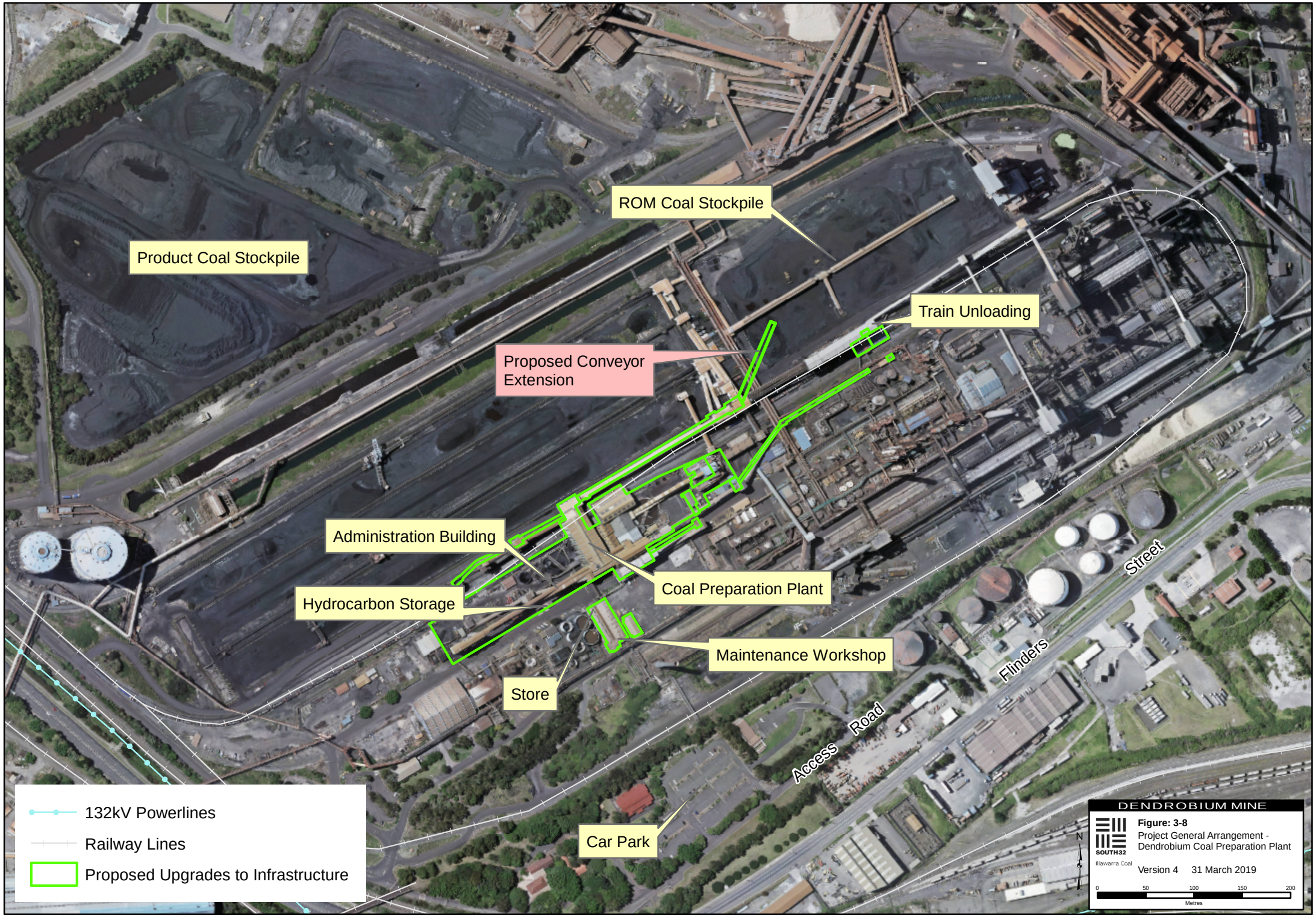
In particular, it is anticipated that the existing excess water pipeline that follows the Kemira Valley Rail Line to the licensed discharge point to Allans Creek (LDP5) under EPL 3241 at Unanderra would need to be upgraded, replaced or duplicated. Any duplicated pipeline would run parallel to the existing 7 km excess water pipeline from Kemira Valley storage tank to LDP5. The anticipated size of the duplicated pipeline required to accommodate predicted increases mine inflows is similar to that of the existing pipeline, and would therefore be located within the existing infrastructure corridor.

This pipeline may also be extended to the Port Kembla industrial precinct within existing infrastructure corridors to provide industrial water for beneficial reuse over the life of the Project. If a section of the pipeline were to extend beyond the DA Area for the Project and/or would result in disturbance beyond the existing infrastructure corridor associated with the rail line, it would be subject to the necessary separate assessment and approval.

3.4.10 Other Surface Facilities and Supporting Infrastructure Upgrades

Upgrades to other supporting facilities such as the Kemira Valley Coal Loading Facility during the life of the Project would be within the current disturbance footprint and would involve replacement, upgrade or addition of existing components during the life of the Project.


CCL 768
Fire Fighting Water Tank and Pump Station
Electrical Substation
Coal Sizer
Rill Tower
O'Briens Drift Infrastructure (Not in use)
Conveyor
Buffer Dam (Sedimentation Pond)
Kemira Valley Tunnel Portal
Break Tank
Coal Stockpile Area
Site Amenities
CCL 768
Site Office
Sedimentation Pond A
ML 1510
Sedimentation Pond B
Discharge Pumps
Proposed Upgrades to Rail Line and Associated Infrastructure
Car Park
Kemira Valley Rail Line
Access Road
Proposed Rail Control Room
132kV Powerline
Dendrobium Mining Lease
N
DENDROBIUM MINE
Figure: 3-7
Project General Arrangement - Kemira Valley Coal Loading Facility
Version 4 31 March 2019
0 25 50 75 100 125
Metres


ROM Coal Stockpile
Product Coal Stockpile
Train Unloading
Proposed Conveyor Extension
Administration Building
Coal Preparation Plant
Hydrocarbon Storage
Maintenance Workshop
Store
Car Park
Flinders Street
Access Road
132kV Powerlines
Railway Lines
Proposed Upgrades to Infrastructure
DENDROBIUM MINE
Figure: 3-8
Project General Arrangement - Dendrobium Coal Preparation Plant
SOUTH32
Illawarra Coal
Version 4 31 March 2019
N
0 50 100 150 200
Metres

3.5 UNDERGROUND MINING OPERATIONS

The Project involves longwall mining operations within CCL 768 to (Figure 3-3):

- extract the Bulli Seam in Area 5; and
- extract the Wongawilli Seam in Area 6.

The underground mining operations for the Project would extract approximately 78 Mt of ROM coal from Areas 5 and 6.

Over the life of the Project, ROM coal would also continue to be extracted from the approved Area 3. This coal extraction would occur under Development Consent DA 60-03-2001 (subject to obtaining an extension to the life of Development Consent DA 60-03-2001, where required).

Due to gas constraints identified in the approved Area 3C (Section 2), the Project would provide an opportunity to safely drain this gas before the approved Area 3C is mined and, therefore, maintain continuity of Dendrobium Mine longwall operations.

The Project would involve extraction of up to 5.2 Mtpa of ROM coal from the Project mining areas.

Underground mining operations would be conducted on a continuous basis, 24 hours per day, seven days per week.

3.5.1 Mining Method

Longwall mining methods and equipment would continue to be employed for the Project. Longwall mining involves the extraction of rectangular panels of coal defined by underground roadways constructed around each longwall. The longwall mining machine travels back and forth across the width of the coal face, progressively removing coal in slices from the panel. Once each slice of coal is removed from the longwall face, the hydraulic roof supports are moved forward, allowing the roof and a section of the overlying strata to collapse behind the longwall machine (referred to as forming 'goaf') (Figure 2-2).

Extraction of coal by longwall mining methods results in the vertical and horizontal movement of the land surface. The land surface movements are referred to as subsidence effects. The type and magnitude of subsidence effects are dependent on a range of variables which include the mine geometry and topography, the depth of mining, the number of seams mined, the coal recovery from each seam, the nature of overlying strata and other geological factors. The subsidence effects pertinent to the Project include non-conventional and systematic subsidence movements.

Subsidence-related monitoring and remediation activities for the Project are discussed in Section 3.13.1 and described in detail in Section 7.2.

3.5.2 Project Mining Domain Constraints

The Project Areas 5 and 6 underground mining areas comprise two distinct domains with differing major constraints (Section 3.1 and Figure 3-2):

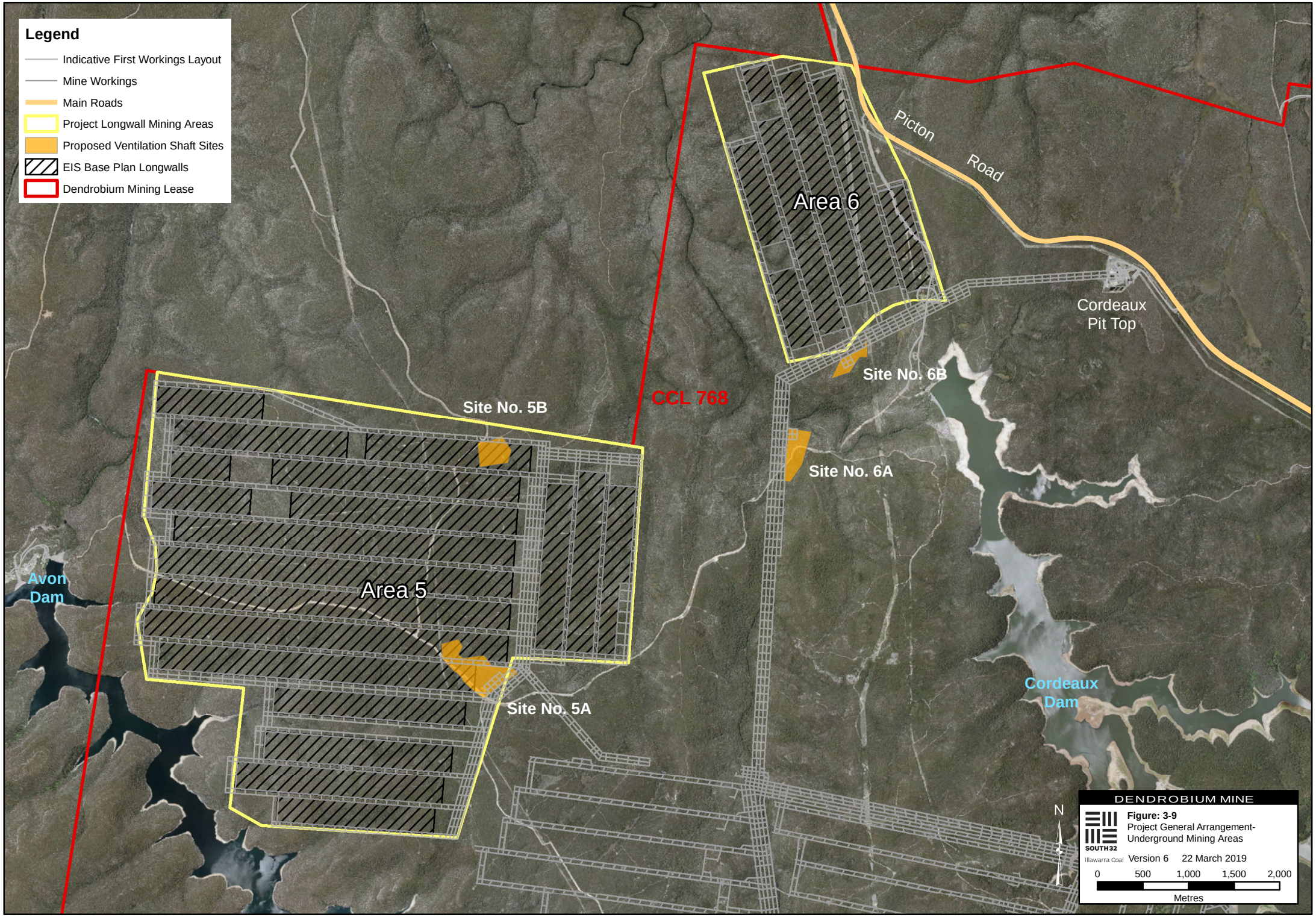
- Area 5 is constrained by the extent of CCL 768 to the west and north and the extent of the approved Area 3 (under Development Consent DA 60-03-2001) to the east. Area 5 is also constrained by igneous intrusions to the east, Avon Dam and Avon River to the south and south-west.
- Area 6 is constrained by Cordeaux Dam and Cordeaux River to the south and west, the extent of CCL 768 to the north and a fault zone to the east.

3.5.3 Project Longwall Design Constraints

Longwalls for the Project would have coal face widths of up to approximately 305 m and extraction height would be restricted to a maximum of 3.9 m. A number of longwall design constraints have been incorporated in the Project underground mining layout to reduce potential environmental impacts in consideration of previous mining experience in Dendrobium Mine Area 3B and key stakeholder feedback.

The longwall layout shown on Figure 3-9 is the EIS Base Plan Longwalls. A number of longwall setbacks from both built and natural features were developed by South32 and are incorporated in the EIS Base Plan design, including:

- longwall setbacks from both the Avon and Cordeaux Dam walls (adopted minimum setback distance of 1,000 m);


Legend
Indicative First Workings Layout
Mine Workings
Main Roads
Project Longwall Mining Areas
Proposed Ventilation Shaft Sites
EIS Base Plan Longwalls
Dendrobium Mining Lease
Area 6
Picton
Road
Cordeaux
Pit Top
Site No. 6B
Site No. 6A
CCL 768
Site No. 5B
Area 5
Avon
Dam
Site No. 5A
Cordeaux
Dam
N
DENDROBIUM MINE
Figure: 3-9
Project General Arrangement-
Underground Mining Areas
SOUTH32
Illawarra Coal
Version 6
22 March 2019
0
500
1,000
1,500
2,000
Metres

- no direct undermining of the existing Avon and Cordeaux Dam waterbodies, with a minimum 300 m longwall setback adopted from the existing dam Full Supply Levels (FSLs); and
- longwall setbacks from named watercourses (i.e. Cordeaux River, Avon River and Donalds Castle Creek) to achieve 200 millimetres (mm) or less of predicted Project subsidence related closure.

The Project mine geometry was then further refined to include a number of additional reductions to the extent of mining to avoid the direct undermining of mapped "key stream features" (i.e. pools >100 cubic metres [m^3] and permanent, waterfalls >5 m and with a permanent pool at the base) as identified during site investigations of all mapped streams overlying the Project underground mining Areas 5 and 6.

To achieve these refinements, South32 would modify individual longwall geometry, through methods such as:

- shortening of longwalls; and
- leaving un-mined coal blocks (i.e. not mining coal from a portion of a longwall, via an additional longwall movement).

The adopted longwall constraints that would be incorporated in the Project longwall mining layout are summarised in Table 3-4. There are a number of alternative longwall layouts that would also meet these same Project constraints and, therefore, achieve the same environmental outcome as assessed in this EIS.

Table 3-4
Summary of Constraints Incorporated in the Project Longwall Mining Layout

Adopted Project Constraint	Context
1,000 m minimum setback from existing Avon/Cordeaux Dam walls for any secondary extraction.	The Dams Safety Committee (DSC) must endorse any mining within the DSC Notification Zones. The DSC has published Guidance notes, including: • No uncontrolled extraction (e.g. full-sized longwalls) within 1.7x depth of cover of existing dam structures[1]. • No mining (any) within 1.2 x depth of cover of existing dam structures.
No mining below existing Avon/Cordeaux Dams waterbodies, adopting a 300 m setback from existing dam FSL.	The DSC must endorse any extraction under stored water for existing storages, including first workings and secondary workings. The DSC has endorsed several instances of first workings under Lake Cordeaux at the approved Dendrobium Mine. DSC endorsement for mining to date in the approved Area 3B has included a minimum horizontal distance to the FSL equal to 300 m.
Setbacks from named watercourses (as defined by the NSW Department of Lands) to achieve 200 mm or less predicted additional Project subsidence-related closure.	Relevant to Cordeaux River, Avon River and Donald Castle Creek for the Project mining domains.
Setbacks from mapped "key stream features": • Setback of 50 m when mining will occur on one side of the "key stream feature". • Setback of 100 m when mining will occur on more than one side of the "key stream feature".	Applies to South32 mapped features along streams within the Project Study Area[2] as follows: • Pools (>100 m^3 and permanent). • Waterfalls/Steps (>5 m and with a permanent pool at base). Setback distances are based on observations from the Dendrobium Mine, and the setbacks are designed to maximise the likelihood that the stream feature will not be physically damaged by subsidence.

1 This would require approximately 750 m setback or less based on Project depths of cover, but South32 has adopted a Project setback (≥1,000 m) greater than the DSC recommendation.

2 Study Area as defined in MSEC, 2019.

It is proposed that the longwall design constraints in Table 3-4 would be referenced in the Development Consent, should the Project be approved. This would facilitate subsequent detailed design of Project longwall layouts consistent with this EIS.

Final Project longwall layouts would be subject to review and approval as a component of future Extraction Plans developed in consultation with the relevant authorities and to the satisfaction of the Secretary of the DPE.

South32 would also implement an adaptive management approach to achieve any relevant performance measures to maintain the safety and serviceability of surface infrastructure during the life of the Project. Adaptive management would involve the monitoring and periodic evaluation of environmental consequences against subsidence performance measures and, if necessary, mitigation measures and/or the mine design and mining extent may be adjusted to achieve the Development Consent performance measures.

Indicative Mining Schedule

An indicative mining schedule for the Project is presented in Table 3-5 and is based on the planned maximum ROM coal production rate of 5.2 Mtpa.

The actual timing and mining sequence may vary to take account of localised geological features, coal quality characteristics, detailed mine design, mine economics, market volume requirements, and/or adaptive management requirements.

3.5.4 Underground Mine Access and Materials Handling

Underground Mine Access and Development Works

Personnel and materials access to Area 5 would be from the Dendrobium Pit Top and the Dendrobium Tunnel. Access to Area 6 would be via the Dendrobium Pit Top and/or the Cordeaux Pit Top.

An access/egress winder would also be installed at the ventilation shaft sites to facilitate emergency transportation to/from the underground mining operations.

Underground main roads would be developed to access and support the Project underground mining areas (i.e. for access, ventilation and coal clearance).

Each longwall would be formed by developing gate roads (the tailgate and maingate roads). To construct the gate roads, roadways (headings) would be driven parallel to each other using continuous miners.

The headings that form the gate roads would be connected by driving a “cut-through” from one heading to another at regular intervals (e.g. at 130 m spacings) (Figure 2-2). This leaves a series of pillars of coal along the length of the gate road that support the overlying strata.

ROM Coal Handling

ROM coal would be transported from the Project underground operations to the Kemira Valley Coal Loading Facility via an underground conveyor network, reaching the surface via the Kemira Valley Tunnel.

At the facility, ROM coal would continue to be temporarily stockpiled before being loaded onto trains for transport to the Dendrobium CPP. Up to 5.2 Mtpa of ROM coal from Areas 5, 6 and 3 would be handled at the Kemira Valley Coal Loading Facility over the life of the Project.

A material handling schematic for the Project, showing the handling of ROM coal, product coal and coal wash is shown on Figures 3-10a and 3-10b.

3.5.5 Major Underground Equipment

Underground equipment (such as shearers, longwall machines, continuous miners, conveyors and bins) and mobile fleet (such as load haul dump vehicles, drill rigs, shuttle cars and personnel carriers) would be used for the Project.

Underground equipment would be upgraded or replaced during the life of the Project as required.

3.5.6 Mine Ventilation Systems

Ventilation shafts, fans and associated surface infrastructure would be required for the Project to maintain a safe working environment within the underground workings.

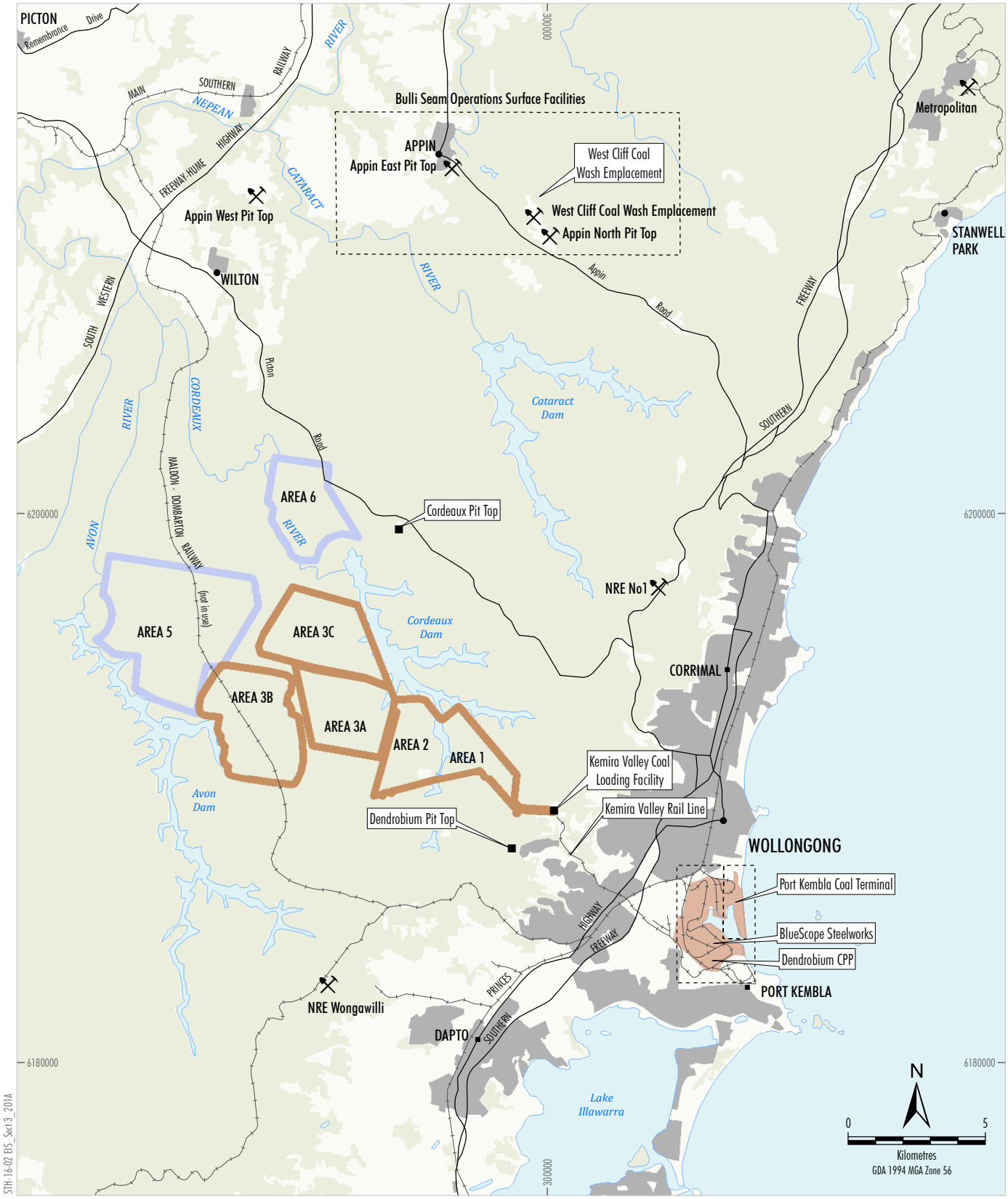
The existing Dendrobium Shafts Nos 1, 2 and 3 would continue to ventilate the Project underground mining areas.

Table 3-5
Indicative Mining Schedule

Project Year	ROM Coal Production (Mt)		Project ROM Coal Handling and Processing (Mt)		
	Approved Dendrobium Mine Mining (Area 3) (DA 60-03-2001)*	Project Underground Mining Areas (Areas 5 and 6)	Total ROM Coal	Coal Wash (Wet)	Total Product Coal
1	4.7	0.2	4.9	1.3	3.7
2	4.4	0.1	4.5	1.2	3.4
3	3.8	0.2	4.0	1.0	3.1
4	3.2	0.4	3.6	0.9	2.7
5	2.0	1.2	3.2	0.8	2.6
6	-	3.4	3.4	0.5	3.0
7	-	5.2	5.2	0.8	4.6
8	-	4.9	4.9	0.7	4.4
9	-	4.4	4.4	0.6	3.9
10	-	4.3	4.3	0.6	3.8
11	-	3.7	3.7	0.5	3.3
12	-	3.8	3.8	0.5	3.4
13	0.0	4.1	4.1	0.5	3.7
14	0.2	3.8	4.0	0.5	3.5
15	0.3	3.3	3.6	0.5	3.1
16	0.3	2.9	3.2	0.5	2.7
17	0.3	3.2	3.5	0.6	3.0
18	0.2	3.6	3.8	0.7	3.2
19	0.2	3.5	3.7	0.6	3.1
20	3.1	0.5	3.6	0.9	2.7
21	3.6	0.3	3.9	1.1	2.8
22	3.7	0.3	4.0	1.1	3.0
23	3.3	0.3	3.6	1.0	2.7
24	1.4	2.3	3.7	1.2	2.6
25	-	3.6	3.6	1.2	2.6
26	-	4.3	4.3	1.5	3.1
27	-	4.7	4.7	1.6	3.2
28	-	4.7	4.7	1.6	3.3
29	-	0.4	0.4	0.1	0.3

Note: The combined total of product coal and coal wash is greater than total ROM coal due to changes in moisture content. Other totals may not add exactly due to rounding.

* ROM coal extraction in Area 3 would continue to be conducted in accordance with Development Consent DA 60-03-2001.



LEGEND

- Road
- Railway
- Urban Area
- Dendrobium Underground Mining Area - Proposed Project
- Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)

Source: Geoscience Australia, 2006; Department of Industry (2018); Department of Finance, Services & Innovation (2018);

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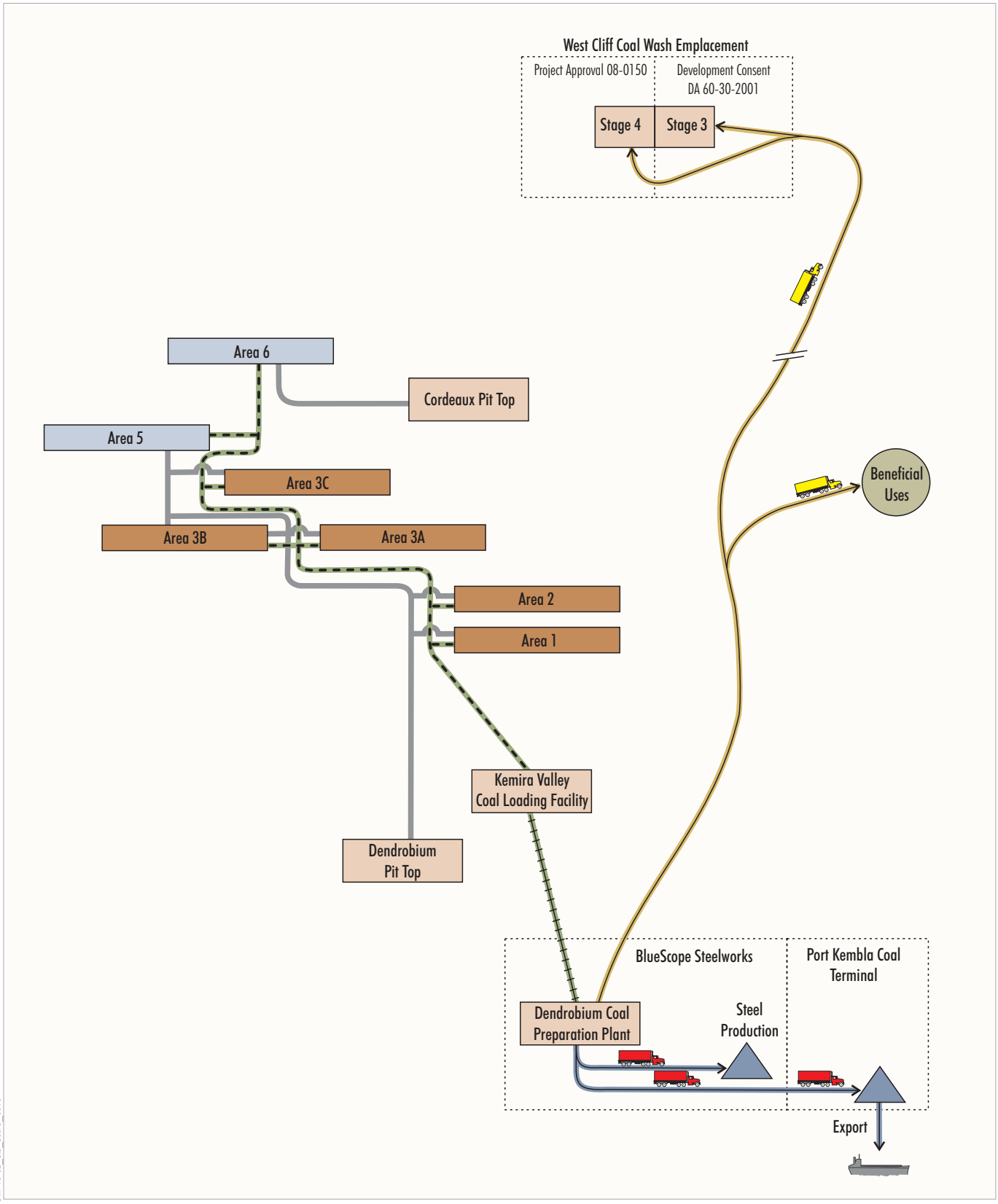
Materials Handling Spatial Relationship

Figure 3-10a



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DENDROBIUM MINE

Material Handling Schematic Flowsheet

Figure 3-10b

Dendrobium Shafts Nos 1 and 2 are downcast (or intake) ventilation shafts that draw fresh air into the underground workings. Dendrobium Shaft No 3 is currently an upcast (or exhaust) ventilation shaft that uses fans to draw air out of the underground workings.

Dendrobium Shaft No 3 may be converted to a downcast ventilation shaft during the life of the Project.

The Project would also involve the development of the following ventilation infrastructure (Figure 3-9):

- an additional ventilation shaft site to support Area 5 (Site No 5A);
- an optional additional ventilation shaft site to support Area 5 (Site No 5B); and
- two additional ventilation shaft sites to support Area 6 (Site No 6A and Site No 6B).

Further mine planning and detailed ventilation studies would be required during the life of the Project to determine if development of a ventilation shaft at Site No 5B is required to support Area 5. In the event that Site No 5B is required, Longwall 508B may need to be shortened to allow the development of a shaft in this location. The final longwall and ventilation arrangement would be presented in the relevant Extraction Plan.

The ventilation shaft sites may be used as downcast and/or upcast ventilation shafts during the life of the Project. Only one shaft that supports Area 6 would be used as an upcast shaft at any one time.

Each upcast ventilation shaft site would have the following infrastructure:

- up to two concrete-lined or steel-lined shafts;
- up to three ventilation fans;
- power supply;
- electrical switchrooms, transformers, switchyard and other electrical infrastructure;
- gas drainage, monitoring and management systems, which may involve gas reticulation and flaring;
- site access road and appropriate security (i.e. fencing) to prevent unauthorised access to the site;
- sediment control infrastructure; and
- other associated ancillary infrastructure.

Each downcast ventilation shaft site would have the following infrastructure:

- one concrete-lined or steel-lined shaft;
- site access road and appropriate security (i.e. fencing) to prevent unauthorised access to the site;
- sediment control infrastructure; and
- other associated ancillary infrastructure.

3.5.7 Gas Management and Abatement

Pre-mining gas drainage and goaf gas drainage would be required for the Project to reduce the gas content in the coal seams to levels suitable for safe underground mining operations. Gas monitoring systems would be implemented for the Project to monitor gas composition of the air in the underground workings (e.g. carbon dioxide and methane levels) to maintain a safe working environment.

Pre-Mining Gas Management

Gas would be drained from the Wongawilli and Bulli Seams, and adjacent strata, by drilling in-seam (i.e. horizontal) boreholes into the coal seam in advance of mining. Pre-mining gas drainage would generally be facilitated by underground cross panel drilling. Gas would be drained through an underground collection system and delivered to centralised gas management infrastructure at the surface.

Post-Mining Gas Drainage

Gas would also be drained from the goaf area post-mining to ensure safe operations and maintain the rate of longwall mining operations. Post-mining gas drainage would be undertaken via underground drilling methods into the goaf. Gas drained from the goaf areas would be collected through the underground collection system for management at the surface.

Hierarchy of Gas Management and Abatement

Centralised gas management infrastructure would be constructed at the upcast ventilation shaft sites (Section 3.5.7).

Gas would be delivered to the centralised gas management infrastructure via gas pumps, a network of underground pipes and a shaft. Surface gas management infrastructure would be fully fenced and may include flares, pumps, nitrogen tanks, gas monitoring, water collection, surface pipes and other ancillary infrastructure.

Gas would be flared or, if the gas was too low in methane content for flaring (or other operational reasons), vented to the atmosphere.

3.5.8 Water Management Systems

The Project underground mining operations would use a combination of potable water and recycled water.

Treated recycled water would be used for underground dust suppression, cooling of underground equipment (development units and secondary supports) and for fire fighting purposes. Potable water from Sydney Water would be used for longwall hydraulic equipment and as a backup supply when recycled water is not available.

Water that accumulates in the underground workings, including groundwater inflows, would be collected and transferred directly into the Nebo workings and/or Kemira workings via a series of underground sumps, pumps and pipelines.

South32 would use flow meters to monitor the volume of water being pumped around the underground operations. Water that leaves the underground workings in ROM coal and ventilation air would continue to be monitored to inform periodic review of the site water balance.

Excess water that accumulates in the underground workings would continue to be discharged via the existing licensed discharge point to Allans Creek (LDP5) under EPL 3241.

South32 is also investigating options for the beneficial reuse of excess mine water with major water users in the Illawarra. Subject to the finalisation of feasibility studies and commercial agreements, the existing mine water discharge pipeline would be extended along the Kemira Valley Rail Line or other infrastructure corridors, to industrial and/or other water users to facilitate the transfer of excess water for beneficial re-use.

3.6 ROM COAL TRANSPORT AND PROCESSING

3.6.1 ROM Coal Sizing, Stockpiling and Transport

Up to 5.2 Mtpa of ROM coal from Areas 5, 6 and 3 would be transferred to the surface at the Kemira Valley Coal Loading Facility via the Kemira Valley Tunnel.

ROM coal would be conveyed from the Kemira Valley Tunnel to the existing coal sizing unit, which is a rotary breaker that reduces the top size of the coal (Figure 3-7). Sized ROM coal would be conveyed to the rill tower and temporarily stored in a stockpile with an approximate capacity of 150,000 tonnes (t), prior to being transported.

Train loading would continue to occur via feeders from the base of the stockpile, where coal is fed into rail wagons by either gravity or bulldozer.

Loaded trains would be sprayed with water to control dust emissions during transportation.

When required for stockpile management, a bulldozer or loader would operate on the stockpile between 7.00 am and 10.00 pm.

The Project would use the existing surface facilities at the Kemira Valley Coal Loading Facility, with minor augmentations and upgrades to existing equipment, as described in Section 3.4.10.

At the Dendrobium CPP, the train wagons would continue to be positioned over a rail unloading hopper system located below the rail line.

The unloaded coal would then be transferred to either the CPP feed bins or to a ROM stockpile area to the west of the rail line (Figure 3-7).

3.6.2 Dendrobium Coal Preparation Plant

A general arrangement of the Dendrobium CPP is provided in Figure 3-8.

The Dendrobium CPP would continue to receive small volumes of ROM coal, via the public road network, from the Bulli Seam Operations.

Sized ROM coal would be temporarily stockpiled at the Dendrobium CPP or fed directly into the CPP for processing at a rate of up to 5.2 Mtpa.

ROM coal would be fed through the existing conveyor and distributed amongst dense medium and flotation circuits for processing.

The CPP would produce the following main streams:

- metallurgical coal;
- energy coal; and
- coal wash.

The existing CPP comprises a range of components that can be generally classified into three major circuits, the coarse coal, small coal and fine coal circuits. Each of these circuits include components that separate coal materials on the basis of size (e.g. screens) and on the basis of material type (e.g. cyclones, flotation cells, jig/drum). Each circuit has links to each of the other circuits for recycling of undersize or oversize material.

The small coal and fine coal circuits also include components that are used to dewater coal products (e.g. centrifuges) and the fine coal circuit includes components that are used to dewater coal and coal wash (e.g. thickeners, filters and tailings presses).

During the life of the Project, an existing thermal drying facility may be upgraded to reinstate operations and/or replaced with other dewatering units (e.g. thickeners and filters).

Metallurgical coal and energy coal product streams would exit the CPP via conveyor and would be stockpiled separately.

Coal wash would report to the coal wash loading bin.

Further details on product coal handling and transportation and coal wash management are provided in Sections 3.7 and 3.8 respectively.

3.7 PRODUCT COAL HANDLING AND TRANSPORTATION

The product coal production schedule for the Project is provided in Table 3-5.

Product coal from the Dendrobium CPP would continue to be temporarily stockpiled prior to being transported. Product coal would be transported from the Dendrobium CPP to the Port Kembla Steelworks for use in the steelmaking process or to the Port Kembla Coal Terminal for transport to Liberty Primary Steel Whyalla Steelworks and other export customers. All product coal transportation would be via private internal roads within the Port Kembla industrial precinct.

Product coal transportation would occur on a continuous basis (24 hours per day, seven days per week).

3.8 COAL WASH MANAGEMENT

3.8.1 Coal Wash Production

Over the life of the Project, it is estimated that up to approximately 15.2 Mt of additional coal wash would be produced from the processing of coal from Project underground mining areas. Approximately 9.4 Mt of coal wash would also be produced from processing coal from remaining areas of Area 3 during the life of the Project.

An indicative production schedule (including coal wash generation by the approved Bulli Seam Operations under Project Approval 08_0150) of coal wash required to be emplaced at the West Cliff Coal Wash Emplacement and/or available to be supplied for beneficial re-use is provided in Table 3-6.

While the total coal wash quantities are based on planned maximum production (Section 3.6.1), the actual quantity produced in any one year may vary to take account of localised geological features, detailed mine design and the actual mine development sequence.

3.8.2 Coal Wash Physical and Chemical Characteristics

Coal wash generally consists of a mixture of carbonaceous shale and mudstone with minor proportions of sandstone. Small quantities of low quality coal can also be present.

All coal wash (including coarse and fine coal wash) generated at the Dendrobium CPP reports to a single coal wash loading bin.

The coal wash material produced by the Dendrobium CPP is primarily comprised of silicon oxide, boehmite (an aluminium oxide hydroxide), carbon, iron oxide and moisture.

The material is not classified as hazardous according to Safe Work Australia criteria and is not classified as a dangerous good by the criteria of the Australian Dangerous Goods Code (ADG Code).

Contaminants in the coal wash material do not exceed the specific contaminant concentration (SCC) or toxicity characteristics leaching procedure (TCLP) test values for general waste in the *Waste Classification Guidelines – Part 1: Classification of waste* (EPA, 2014).

Monitoring data shows that the combined underdrainage from Stages 1, 2 and 3 of the West Cliff Coal Wash Emplacement, following emplacement over approximately 40 years, is generally neutral or slightly alkaline.

The presence of the West Cliff Coal Wash Emplacement for such a long period is essentially a long-term batch trial and shows that there is no evidence of acid generation from the coal wash.

The water quality impact assessment for the West Cliff Stage 3 Coal Wash Emplacement (EcoEngineers, 2007) concluded that there was unlikely to be export of significant concentrations of heavy metals or organic compounds from the emplacement area.

3.8.3 Beneficial Use of Coal Wash

South32 is committed to supporting the continued supply of coal wash for engineering purposes (e.g. civil construction fill) or for other beneficial uses.

Between June 2014 and June 2018, South32 diverted approximately 2.0 Mt of coal wash away from emplacement to alternate customers.

As well as current shorter-term supply contracts, South32 has commercial arrangements in place for long-term supply of coal wash to Lend Lease for use as construction fill material at the Calderwood Valley residential development. Approximately 0.6 Mt of coal wash material is forecast to be required by Lend Lease in the first two years of the Project. It is anticipated there will be further use of coal wash from the Project at this and other developments during the life of the Project.

The Project would, therefore, involve the road transportation of up to 1.6 Mtpa of coal wash material from the Dendrobium CPP to customers for beneficial use, including in the Wollongong, Shellharbour and/or Wollondilly LGAs.

3.8.4 West Cliff Coal Wash Emplacement

The Project would involve the continued use of the West Cliff Stage 3 and Stage 4 Coal Wash Emplacement for the emplacement of coal wash that is not diverted to alternate beneficial uses.

Coal wash from the Dendrobium CPP would be loaded into trucks from the existing coal wash loading bin. The transport of washed coal from the West Cliff Colliery to Port Kembla is currently undertaken by haul trucks operating under Bulli Seam Operations Project Approval 08_0150, and these trucks would continue to be back-loaded for transporting coal wash from the Dendrobium CPP to the West Cliff Coal Wash Emplacement.

A dedicated truck fleet for the Project may be used in the final years of the Project life if the Bulli Seam Operations does not extend its operations to 2048 following planned cessation in 2041 (Table 3-6). The approved arrangement of the West Cliff Coal Wash Emplacement is shown on Figure 3-11.

It is anticipated there will be approximately 25.2 Mt of capacity remaining in the West Cliff Stage 3 Coal Wash Emplacement at the commencement of the Project.

The West Cliff Stage 4 Coal Wash Emplacement (not yet commenced) has an approved capacity of 26 Mt.

Therefore, the currently approved West Cliff Coal Wash Emplacement has sufficient capacity for the Project, the Approved Mine and the approved Bulli Seam Operations.

If development consent is granted for the Project, the new consent would prevail to the extent of any inconsistency with Development Consent DA 60-03-2001 in relation to development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement.

Development and rehabilitation of the West Cliff Stage 4 Coal Wash Emplacement would continue to be conducted in accordance with Project Approval 08_0150 for the Bulli Seam Operations.

Table 3-6
Indicative Production Schedule of Coal Wash to be Emplaced at the West Cliff Coal Wash Emplacement and/or Available to be Supplied for Beneficial Reuse

Year	Coal Wash Production from Project Processing Activities (Mt)*	Approved Bulli Seam Operations Coal Wash Production (Mt)#	Total Coal Wash Production (Mt)
1	1.3	0.8	2.1
2	1.2	1.2	2.3
3	1.0	1.2	2.2
4	0.9	1.2	2.2
5	0.8	1.2	1.9
6	0.5	1.2	1.8
7	0.8	1.2	2.0
8	0.7	1.3	2.0
9	0.6	1.3	1.9
10	0.6	1.2	1.8
11	0.5	1.3	1.8
12	0.5	1.5	2.0
13	0.5	1.4	1.9
14	0.5	1.4	1.9
15	0.5	1.5	2.0
16	0.5	1.3	1.8
17	0.6	1.4	2.0
18	0.7	0.6	1.2
19	0.6	0.7	1.3
20	0.9	0.6	1.5
21	1.1	0.6	1.7
22	1.1	-	1.1
23	1.0	-	1.0
24	1.2	-	1.2
25	1.2	-	1.2
26	1.5	-	1.5
27	1.6	-	1.6
28	1.6	-	1.6
29	0.1	-	0.1
TOTAL	**24.6**	**24.1**	**48.6**

Note: Totals may not add exactly due to rounding.

* Includes coal wash generated from processing of ROM coal from the approved Dendrobium Mine (Area 3) mining areas and Project underground mining areas (Areas 5 and 6).

Approximation based on current mine scheduling. This would continue to occur under Project Approval 08_0150.


Stage 4
(Approved - not yet commenced)
Dharawal National Park
Dharawal SCA
Stage 3
(Currently Active)
Stage 2
(Rehabilitated)
CCL 724
Stage 1
(Complete)
West Cliff Coal Wash Emplacement
Stage 1 Complete
Stage 2 Rehabilitated
Stage 3 Currently Active
Stage 4 Approved (not yet commenced)
Dendrobium Mining Lease
National Park
State Conservation Area
N
DENDROBIUM MINE
SOUTH32
Illawarra Coal
Figure: 3-11
General Arrangement of
West Cliff Coal Wash Emplacement
Version 3
31 March 2019
0
100
200
300
400
500
Metres

It is intended that development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement would continue to be integrated with the management activities at the West Cliff Colliery surface facilities, including continued implementation of the West Cliff Coal Wash Emplacement Area Management Plan.

3.9 WATER MANAGEMENT

The Project would involve the use of the existing water management infrastructure with minor augmentations and extensions, including the progressive developments of sumps, pumps, pipelines, water storage and other water management infrastructure.

Underground and surface operations would continue to use a combination of potable and recycled water. Potable water would be supplied by Sydney Water. Recycled water would continue to be sourced from the adjacent underground mine workings.

The Project water management schematic is shown on Figure 3-12.

A description of the water management system for the Project is provided below.

3.9.1 Underground Operations

The underground mining operations for the Project would be supported by water management systems to transfer accumulated water from the underground workings directly into the Nebo workings and/or the Kemira workings, which act as water storage areas for the Dendrobium Mine (HEC, 2019).

Further details on water management systems for the underground mining operations of the Project are provided in Section 3.5.9.

The site water balance demonstrates sufficient water supply is available to meet the demand of the underground operations (HEC, 2019).

3.9.2 Dendrobium Pit Top

The Project would continue to use the existing water management facility at the Dendrobium Pit Top to separate clean, oily and dirty water.

Recycled water from the Nebo workings supplemented by potable water from Sydney Water would continue to be used in the bathhouse and associated office facilities. Effluent from bathhouse and office facilities would be separated into grey water and sewage streams (HEC, 2019). Sewage would be directed to the town sewerage system. Bathhouse grey water along with water from the washdown bay, workshop and sedimentation ponds would be treated at the water treatment facility prior to being injected back into the Nebo workings.

Recycled water, sourced from the Nebo workings, would also be used for:

- dust suppression;
- washdown; and
- general hose-down purposes.

Runoff from the general yard area and portal road would continue to be directed to the sedimentation pond. Water from the sedimentation pond would be pumped to the water treatment facility prior to injection into the Nebo workings. Water from the Nebo workings is dosed with sodium hypochlorite before being recycled for use in the Dendrobium Pit Top or Kemira Valley (HEC, 2019). Runoff from the washdown bay would continue to be directed to the water treatment facility, where it would be processed through an oil water separation unit prior to being injected back into the Nebo workings.

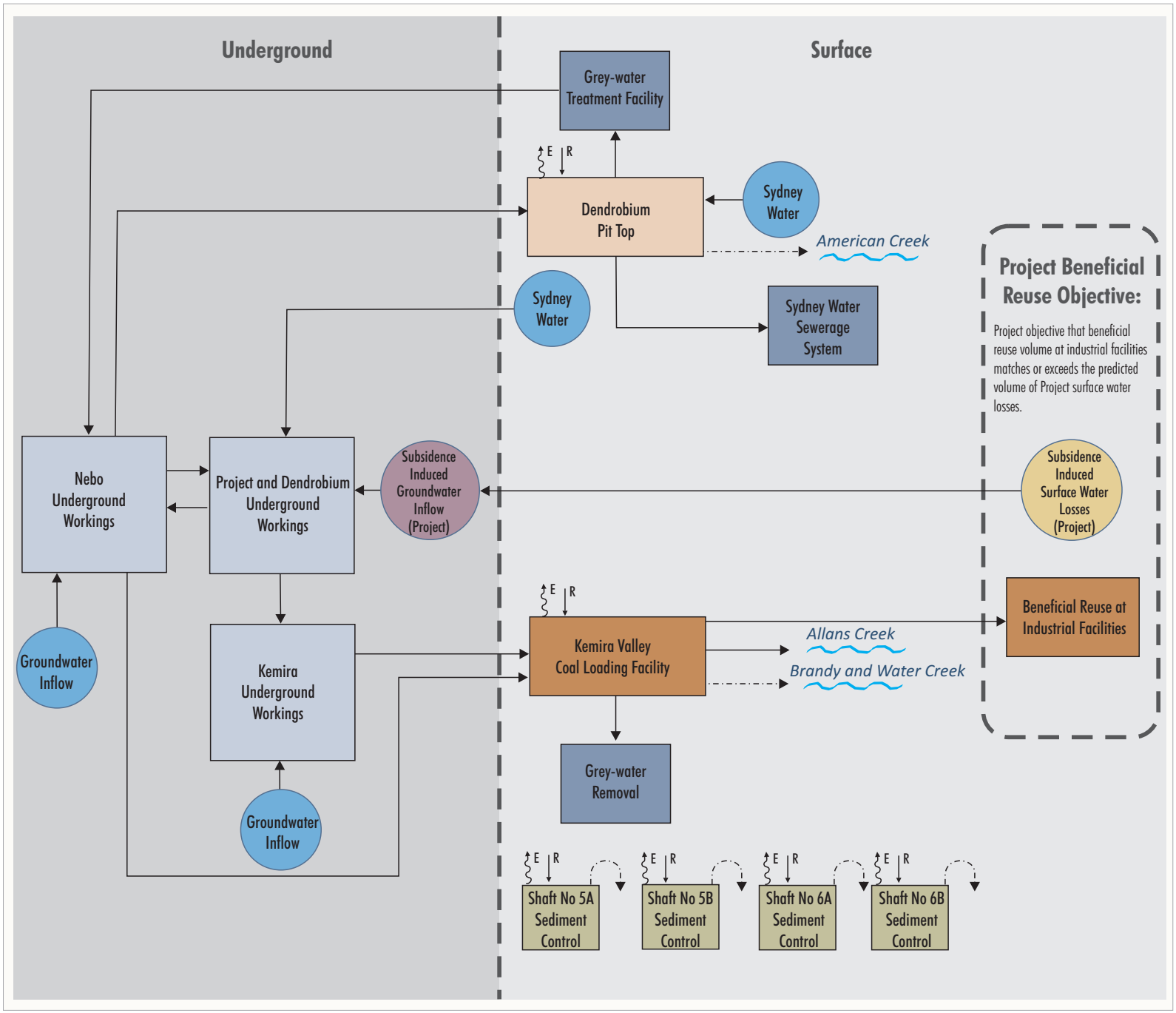
The site water balance identifies sufficient water supply is available to meet the demand at the Dendrobium Pit Top (HEC, 2019). Pumping infrastructure would recycle surplus and effluent flows to the Nebo workings.

3.9.3 Kemira Valley Coal Loading Facility

Kemira Valley Coal Loading Facility would continue to use recycled water, runoff water and stormwater for the Project. Recycled water would be sourced from the Nebo workings and Kemira workings and stored on-site in the break tank.

Recycled water would be used for:

- dust suppression (backup supply);
- general hose-down purposes; and
- amenities (e.g. toilets).



LEGEND
Overflow
Pumped Flow
R
E
Rainfall/Runoff
Evaporation

SOUTH32
Illawarra Coal

DENDROBIUM MINE

Project Water Management Schematic

Figure 3-12

STH-16-02_EIS_Sect 3_002A

Stormwater would continue to be captured at the Kemira Valley Coal Loading Facility via the on-site sediment ponds and buffer dam. Stormwater would continue to be used as the primary supply for the Kemira Valley Coal Loading Facility dust suppression system and to maintain the water level in the fire tank (HEC, 2019).

Excess mine water that accumulates at the Kemira Valley Coal Loading Facility from the underground mine workings would continue to be discharged via the existing licensed discharge point to Allans Creek (LDP5) under EPL 3241. South32 is investigating options for the beneficial re-use of excess mine water with major water users in the Illawarra.

The site water balance demonstrates that sufficient water supply is available to meet the demand at the Kemira Valley Coal Loading (HEC, 2019).

Sewage and effluent at the Kemira Valley Coal Loading Facility would continue to be removed by a licensed waste contractor.

3.9.4 Cordeaux Pit Top

The surface facilities at Cordeaux Pit Top (Figure 3-6) have been designed to prevent dirty water runoff from the site entering WaterNSW land. Runoff from hardstand areas would continue to be directed to a holding dam (HEC, 2019).

Water from the holding dam would continue to be transferred by pump to a settlement dam. The water would then be transferred to underground mine workings via a gravity feed pipeline. This arrangement negates the need for surface discharge (HEC, 2019).

Clean area catchment runoff from the Cordeaux Pit Top (including the sealed employee car parking area) would continue to report to the sand filter lagoon and would leave site via the sand filter underflow discharge point (HEC, 2019).

Any water used at the Cordeaux Pit Top to support underground mining operations would be recycled mine water. This recycled water would primarily be used for dust suppression and for charging of fire lines.

Potable water would continue to be brought to site by road tanker as required (HEC, 2019).

The existing stormwater controls and sewage treatment system (effluent holding tank serviced by road tanker) at Cordeaux Pit Top is adequate for its current use, however, would be upgraded for the Project. New water management infrastructure would also be developed at the Cordeaux Pit Top to accommodate the Project, which would occur within the existing surface lease area and current disturbance footprint. Any such upgrades would be designed to maintain the existing performance measures (i.e. no runoff to WaterNSW land) and would be in accordance with the relevant EPL.

3.9.5 Ventilation Shafts

The Dendrobium No 1 Shaft site has been revegetated to control runoff and erosion, and runoff flows to the surrounding landscape.

The Dendrobium Nos 2 and 3 Shaft sites have been revegetated to minimise the potential for the release of sediment-laden water to the surrounding landscape.

The Dendrobium Nos 2 and 3 Shaft sites would continue to capture site water runoff in existing sediment ponds.

The additional ventilation shaft sites would be constructed with appropriate erosion and sediment control infrastructure consistent with the design principles of the existing shaft sites.

3.9.6 Dendrobium CPP

Dendrobium CPP would continue to use recycled water from BlueScope Steel for use in the Dendrobium CPP and potable water purchased from Sydney Water for the administration building and associated amenities (HEC, 2019).

Dendrobium CPP water would be reclaimed from the process through a floor drain into collection pits where pumps would be used to deliver water back to the CPP.

Sewage and effluent would continue to be directed to the site's sewerage system.

3.10 INFRASTRUCTURE AND SERVICES

Existing surface infrastructure and services would continue to be used throughout the Project life, with required upgrades and extensions.

Surface infrastructure and services would continue to operate 24 hours per day, seven days per week.

The Project involves the use of the existing Cordeaux Pit Top, including current mining support activities, with minor upgrades as described in Section 3.4.6. Mining infrastructure at the Cordeaux Pit Top site is currently under care and maintenance.

3.10.1 Surface Facilities

The Project would use the existing surface facilities (such as administration buildings, bathhouses, workshops and storage areas) with upgrades and extensions as required (Section 3.4).

An indicative surface mobile equipment fleet, which would be used during periods of typical operations, is provided in Appendix J. Additional surface fleet may be present for short periods, for example during longwall change-outs, scheduled plant shutdowns or other maintenance programs over the life of Project (Section 3.4).

3.10.2 Access Roads and Haul Roads

The Project would continue to use existing access roads at the surface facilities at the Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Cordeaux Pit Top, Dendrobium CPP and Dendrobium Nos 1, 2 and 3 Shafts. The Project would also involve an increase in the use of the access road at the Cordeaux Pit Top later in the Project life.

A new access road would be constructed off Cordeaux Road to service the additional car parking area for the Dendrobium Pit Top, with new pedestrian access (e.g. pedestrian road crossing or tunnel constructed under Cordeaux Road). Access roads would also be developed or improved for the new ventilation shafts.

As the underground mining operations progress, additional minor unsealed access roads would be developed, where required, to support surface monitoring, remediation or exploration activities. Wherever practical, existing access roads would be used.

Product coal transportation from the Dendrobium CPP to Port Kembla Steelworks or the Port Kembla Coal Terminal would continue to use existing private internal haul routes.

Coal wash from the Dendrobium CPP would continue to be hauled to the West Cliff Coal Wash Emplacement and to customers for beneficial use in the region via the public road network.

3.10.3 Energy and Electricity Supply and Distribution

Energy consumption would be in the form of diesel fuel and electricity.

Diesel fuel demand would be associated with the use of mobile equipment (such as stockpile dozers, men and materials transporters and vehicles servicing the underground mining operations).

The main electricity requirements for the Project would include:

- mine ventilation fans;
- coal conveyance equipment;
- coal cutting equipment;
- compressors;
- bathhouse heating;
- other underground mining operations; and
- coal processing at the Dendrobium CPP.

The Endeavour Energy high voltage distribution network would continue to supply most of the electricity requirements of the Project.

Electricity for the Project underground mining operations would be distributed via the existing substation located adjacent to the Kemira Valley Coal Loading Facility. Electricity would be reticulated to the underground mining operations through cables running along the coal conveyor route.

As the Project progresses, additional powerlines and/or substations (e.g. down-hole electricity supply to advancing longwall operation and surface facilities) and upgrades to existing powerlines would be required, and may be subject to separate approvals through the relevant electricity supply authority.

3.10.4 Surface Services

Services such as compressed air, diesel, electricity and water required for the advancing longwall operations or ventilation would be delivered from the surface via the Dendrobium Pit Top, Cordeaux Pit Top and service boreholes.

As the mining operations progress, additional service boreholes would be installed, and would generally be located adjacent to other surface infrastructure areas (e.g. new ventilation shafts), resulting in minimal additional disturbance.

If required outside of the proposed ventilation shaft site disturbance areas, the installation of service boreholes and other surface infrastructure would be subject to environmental assessment studies. These studies and any associated management measures would be detailed in a Surface Services Management Plan. The Surface Services Management Plan would be prepared to the satisfaction of the Secretary of the DPE.

The preparation of a Surface Services Management Plan would include:

- A Vegetation Management Protocol that minimises any potential disturbance of natural vegetation. Surveys would be conducted for threatened flora species and threatened ecological communities (TECs). If any threatened flora species are identified, the proposed site would be relocated to avoid any associated impacts. Clearing of TECs would be avoided, apart from some minor clearing in Shale Sandstone Transition Forest TEC, in which clearing would be kept to a maximum of 1.5 ha. Clearance of all vegetation would be kept to a maximum of 9.5 ha outside of delineated areas. To minimise impacts to the Shale Sandstone Transition Forest TEC, the Vegetation Management Protocol would include the following measures:
  - On-site validation that the vegetation present represents Shale Sandstone Transition Forest TEC.
  - Consideration of re-locating infrastructure to avoid validated Shale Sandstone Transition Forest TEC, where practicable.
  - Consideration of locating infrastructure along existing access tracks or existing disturbed portions of validated Shale Sandstone Transition Forest TEC.
  - If clearing is required, implement appropriate management measures (e.g. pre-clearance surveys, demarcation of a clearance zone to constrain clearance to a minimum, implementation of erosion and sediment control works, progressive rehabilitation works, etc.).
- Design of erosion and sediment control and site water management measures in accordance with applicable guidelines and in consultation with WaterNSW.
- Site-specific Aboriginal heritage inspections and, if required, relocation of the proposed sites to avoid known Aboriginal heritage sites.
- Progressive rehabilitation of the disturbance areas, such that only a practical minimum area is disturbed at any one time.

3.10.5 Site Security and Communications

Existing site security measures would be retained for the Project with upgrades as necessary. Additional security fencing for the Project would be erected where necessary (for example at ventilation shaft sites).

The existing communications systems at the surface facilities and underground mining operations would be retained for the Project with augmentations as necessary.

If required outside of the proposed ventilation shaft site disturbance areas, surface works associated with the installation of, or augmentation to, the communication systems would be subject to preparation of supplementary specialist environmental assessment studies. These studies and any associated management measures would be detailed in a Surface Services Management Plan (Section 3.10.4).

3.10.6 Water Supply and Use

Underground and surface operations would continue to use a combination of potable and recycled water. Potable water would be supplied by Sydney Water. Recycled water would continue to be sourced from underground workings, including adjacent underground mine workings.

Water supply for ventilation shaft construction would be provided by pipeline which would aim to use existing disturbed corridors where possible (subject to agreement from WaterNSW) and/or water truck. Top up water for the gas plant would be supplied by water truck and/or from the underground fire water system.

Further details on water supply and use for the Project are provided in Section 3.9.

3.11 WASTE MANAGEMENT

The Project would generate waste streams of a similar nature to current waste generation at the Dendrobium Mine. Waste sorting would be limited on-site with the majority of recyclable and general waste being recycled or disposed of off-site at an approved waste management facility. The key waste streams for the Project would comprise:

- coal wash (as described in Section 3.8);
- pre-mine/goaf drainage gas (as described in Section 3.5.8);
- general solid waste and recyclables;
- waste oil and grease;
- sewage and effluent; and
- minor quantities of other waste types from mining and workshop activities (e.g. used tyres and oil filters).

South32 would continue to apply general waste minimisation principles (i.e. reduce, re-use and recycling where practicable) to minimise the quantity of wastes that require disposal. The Project would also continue to research and, where it is relevant to do so, develop and implement waste management practices to ensure the disposal waste is minimised.

An overview of the waste types likely to be generated by the Project is presented in Table 3-7.

Further details on the management of general waste and sewage and effluent are provided below.

3.11.1 General Waste

General waste produced by the Project at the surface facilities would continue to be deposited into general waste bins. General waste surface bins would be disposed of by a licensed waste contractor. General waste produced at the underground mining areas would continue to be transported from underground general waste bins to an off-site approved waste handling facility for sorting and recycling or disposal.

3.11.2 Sewage and Effluent

Sewage produced at the Dendrobium Pit Top and sewage and effluent produced at the Dendrobium CPP would continue to be plumbed into the town sewerage system.

Wastewater from bathhouses at the Dendrobium Pit Top would be treated at the on-site water treatment facility. Treated bathhouse water from the Dendrobium Pit Top would be recycled on-site.

Sewage and effluent at the Kemira Valley Coal Loading Facility would continue to be removed by a licensed waste contractor.

Sewage and effluent at the Cordeaux Pit Top would continue to be held in the sewage holding tank and removed by a licensed waste contractor.

3.12 MANAGEMENT OF DANGEROUS GOODS

The transportation, handling and storage of all dangerous goods for the Project would be conducted in accordance with the requirements of the NSW *Work Health and Safety Regulation, 2017*.

The dangerous goods stored for the Project would include compressed gases, flammable and combustible liquids, and corrosive substances.

Based on the quantities proposed to be stored for the Project, it is not anticipated that a Dangerous Goods Licence would be required.

3.12.1 Transport

Dangerous goods required for the Project would be transported in accordance with the appropriate State legislation.

3.12.2 Hydrocarbon Storage

Dendrobium Pit Top

There are three existing hydrocarbon bunded areas that would continue to be used for the Project.

Existing procedures to maintain safe working conditions of the bunded areas, including regular inspections, would continue to be employed for the Project.

The Dendrobium Pit Top has two bulk chemical storage containers within the bunded areas, one for hydraulic oil storage (approximately 16,000 L oil storage capacity) and one for diesel storage, that would be utilised by the Project. Hydrocarbon storages would be operated in accordance with the requirements of AS 1940 *The Storage and Handling of Flammable and Combustible Liquid*.
Hydrocarbons would be delivered to site by tanker.

Table 3-7
Waste Streams Likely to be Generated by the Project

Waste Stream	Indicative Waste Class[1]	Management Method
Coal wash	General Solid Waste (non-putrescible)	Refer to Section 3.8.
Timber, cardboard, paper, steel, scrap metal, commingle, food waste, etc.	General Solid Waste (non-putrescible and putrescible)	Transported to an approved waste handling facility and recycled or disposed as required.
Used oil filters	General Solid Waste (non-putrescible)	Temporarily stored on-site in designated bins prior to removal from site by an appropriately licensed waste contractor.
Used particulate filters		
Other workshop wastes (e.g. rags and oil-absorbent materials that only contain non-volatile hydrocarbons and do not contain free liquids)		
Tyres	Special	Used tyres would be segregated and collected for either repairs (if possible) or disposal by a licensed waste contractor.
Bathhouse water	Liquid	On-site treatment at Dendrobium Pit Top water treatment facility and reuse as recycled water.
Sewage effluent	Liquid	Refer to Section 3.11.2.
Waste oil and grease	Liquid	Used containers would be drained into bulk containers and temporarily stored prior to collection by a licensed contractor for processing off-site.
Waste water from ventilation shaft construction, compressor plant and gas plant	Liquid	Temporarily contained on-site, and then either pumped underground and treated, or trucked off-site for treatment and disposal by an appropriately licensed waste contractor.
Hazardous waste (e.g. explosives, lead-acid or nickel-cadmium batteries and containers that have not been cleaned containing residue of dangerous goods)	Hazardous	Temporarily stored on-site in a designated area prior to removal from the site by licensed contractors.
Contaminated waste or asbestos (if identified)	-	Further assessment and advice would be sought regarding waste classification, handling, treatment, disposal and reporting requirements prior to appropriate disposal.

[1] Described or pre-classified waste in *Waste Classification Guidelines Part 1: Classifying Waste* (EPA, 2014).

In addition to the above permanent bunded areas, portable bunds would continue to be used for transient storage or for transportation of oils and fuels around the site.

Where there is a high potential for hydrocarbon spillage, spill kits and/or bins containing oil absorbent material would be present. Surface personnel would be made aware of the locations of these spill kits and absorbent material bins in their work area. The contents of the spill kits and the oil absorbent material bins would continue to be inspected on a regular basis.

Dendrobium CPP

There are two existing hydrocarbon bunded areas at the Dendrobium CPP that would continue to be used for the Project, including a Methyl iso-Butyl Carbinol storage tank and a diesel storage tank. A small grease and oil storage area is maintained within the main Dendrobium CPP building.

Cordeaux Pit Top

The existing underground bulk diesel storage tank at the Cordeaux Pit Top (approximately 42,000 L holding capacity) would continue to be used for the Project. The storage tank would be managed in accordance with the *Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation*, *2014* (or equivalent).

Other Surface Facilities

Any storage of hydrocarbons at other surface facilities would use self-contained and bunded vessels.

3.12.3 Explosives Storage

The existing explosives storage facilities at the Dendrobium Pit Top and Cordeaux Pit Top would be maintained on-site in the event the underground operations or an emergency require the use of explosives.

The storage of explosives would be conducted in accordance with the NSW *Explosives Act, 2003* and *Explosives Regulation, 2013*.

Explosives would be stored on-site in limited quantities and within the Licence to Store Explosives currently in place at the Dendrobium Pit Top.

A Licence to Store Explosives at the Cordeaux Pit Top would be sought as part of the Project, if required for future Project activities.

3.12.4 Other Substances

The management and storage of chemicals for the Project would be conducted in accordance with South32's prescribed management procedures, and Australian Standards and Codes.

South32 would continue to assess new substances before their use on-site by completing a substance evaluation and risk assessment. Safety Data Sheets (SDSs) and substance evaluations would be available to site personnel.

3.13 REHABILITATION AND REMEDIATION ACTIVITIES

The Project includes ongoing rehabilitation and remediation activities and rehabilitation at mine closure.

3.13.1 Subsidence Monitoring and Remediation

Collection of environmental baseline data and monitoring of subsidence effects, subsidence impacts and associated environmental consequences would occur throughout the life of the Project.

Remediation and rehabilitation of subsidence impacts and associated environmental consequences would occur in accordance with approved Extraction Plans and in consultation with DPE and WaterNSW.

Subsidence monitoring is described in Section 6 and subsidence remediation methodologies are described in Section 7.

3.13.2 Decommissioning and Rehabilitation of Surface Facilities

Surface facilities used for the Project would be decommissioned when they are no longer required or at the end of the mine life where no further ongoing beneficial use is identified.

At closure, works would include the decommissioning and removal of infrastructure, the sealing of mine entrances and land rehabilitation.

Further details of the Project rehabilitation and mine closure activities are provided in Section 7.

3.13.3 Coal Wash Emplacement Rehabilitation

It is intended that development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement would continue to be integrated with the management activities at the West Cliff CPP surface facilities, including continued implementation of the West Cliff Coal Wash Emplacement Area Management Plan.

Progressive rehabilitation of completed sections of the Coal Wash Emplacement would be ongoing. The active emplacement area is kept to a practicable minimum, and as each section of fill reaches the designed height and landform, topsoil is applied and revegetation works are implemented.

Further details of the rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement are provided in Section 7.

3.14 WORKFORCE

3.14.1 Construction and Development

Additional personnel would be required for construction and development activities throughout the life of the Project (Section 3.4):

- Development of underground roadways to access Project underground mining areas.
- Development of coal clearance infrastructure and other ancillary infrastructure required to support Project underground mining areas.
- Construction and development of ventilation shafts and associated infrastructure.
- Upgrades to the Dendrobium Pit Top.
- Upgrades to the Cordeaux Pit Top (later in the Project life).

It is estimated that the Project construction and development workforce would peak in 2020.

Additional short-term contractors would also be required during the operational life of the Project; for example, at the Dendrobium Pit Top or Cordeaux Pit Top during longwall change-outs, and at the Dendrobium CPP during shutdown activities.

Construction would generally occur 7.00 am to 5.00 pm Monday to Sunday. Some construction and development works (e.g. drilling and construction of ventilation shafts, and underground development activities) would occur on a 24 hour per day basis.

3.14.2 Operations

The existing operations at the Dendrobium Mine have a combined operational workforce of approximately 400 people (including South32 staff and on-site contractor personnel).

It is anticipated that the operational workforce would be augmented during the Project to accommodate additional development units and additional gas management works. At full development, the Project would employ in the order of 500 operational personnel. This would continue to include a mixture of South32 staff and on-site contractor personnel. Contractor numbers would vary based on operational requirements and/or to address short-term staffing constraints.

Operations would continue to occur 24 hours per day, seven days per week. The current shift arrangements at the Dendrobium Mine are:

- Administration personnel – 8.00 am to 5.00 pm weekdays.
- Operations day shift personnel – 6.00 am to 4.00 pm Monday to Thursday, 6.00 am to 6.00 pm Friday to Sunday.
- Operations afternoon shift personnel – 2.00 pm to 12.00 am Monday to Thursday.
- Operations night shift personnel – 10.00 pm to 8.00 am Monday to Thursday, 8.00 pm to 8.00 am Friday to Sunday.
- Dendrobium CPP day shift personnel – 7.00 am to 7.00 pm Monday to Sunday.
- Dendrobium CPP night shift personnel – 7.00 pm to 7.00 am Monday to Sunday.

The current shift arrangements at the Dendrobium Mine would generally be retained. During the life of the Project alternative shift configurations may be required to meet operational and industry best practice requirements, or to minimise interaction with non-mine peak hour traffic.

The operational workforce would continue to predominantly reside locally (e.g. within the Wollongong, Shellharbour and Wollondilly local government areas).

Later in the Project life, there would be the option for the majority of personnel and materials access to relocate from the Dendrobium Pit Top to the Cordeaux Pit Top (Section 3.4).

3.15 INTERACTION WITH DEVELOPMENT CONSENT DA 60-03-2001

The Project does not include approved underground mining operations in the Wongawilli Seam in Areas 1, 2, 3A, 3B and 3C at the Dendrobium Mine and associated surface activities (such as monitoring and remediation). These activities will continue to operate in accordance with Development Consent DA 60-03-2001 (as modified).

During the life of the Project it is proposed that the extraction of Project Areas 5 and 6 would be integrated with the extraction of approved Dendrobium Mine Areas 3B and 3C (Section 3.5). The extraction of Area 3C between mining of Areas 5 and 6 would occur after the current approved duration of Dendrobium Mine operational activities (2030). The necessary extension to the operational life of Dendrobium Mine under Development Consent DA 60-03-2001 would be subject to a separate application and approval.

If development consent is granted for the Project, surface facilities and underground roadways used by the Project would be operated in accordance with only the conditions of the Development Consent for the Project rather than Development Consent DA 60-03-2001. This would relate to:

- use of existing roadways and drifts for personnel and materials access, ventilation, dewatering and other ancillary activities related to Areas 5 and 6;
- use of the existing Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Dendrobium CPP and Dendrobium Shafts, including the integrated water management system;
- transport of sized ROM coal from the Kemira Valley Coal Loading Facility to the Dendrobium CPP via the Kemira Valley Rail Line;
- delivery of product coal from the Dendrobium CPP to the Port Kembla Steelworks or Port Kembla Coal Terminal for transport to Liberty Primary Steel Whyalla Steelworks or export;
- transport of coal wash by road to customers for engineering purposes (e.g. civil construction fill), for other beneficial uses and/or for emplacement at the West Cliff Colliery Stage 3 and Stage 4 Coal Wash Emplacement; and
- development and rehabilitation of the West Cliff Stage 3 Coal Wash Emplacement.

[1] **Competent Person Statement:**

The information in this report that relates to estimates of Coal Resources for Illawarra Metallurgical Coal is presented on a 100% basis and represents an estimate as at 30 June 2018. It is based on information compiled by J Gale a full time employee of South32. J Gale is a member of the Australasian Institute of Mining and Metallurgy. The Competent Person has sufficient experience relevant to the style of mineralisation and type of deposit under consideration and to the activities being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. The Competent Person consents to the inclusion in this report of the matters based on their information in the form and context in which it appears.